DEVELOPING A STATE WATER PLAN

# GROUND–WATER CONDITIONS IN UTAH, SPRING OF 1980


by

L. R. Herbert and others

United States Geological Survey



Prepared by the United States Geological Survey
in cooperation with the State of Utah

Published by
Division of Water Resources
Utah Department of Natural Resources

Cooperative Investigations Report Number 19

1980

## CONTENTS



## ILLUSTRATIONS

## TABLES



## CONVERSION FACTORS

Most values are given in this report in inch-pound units followed by metric units in parentheses. The conversion factors used are shown to four significant figures. However, in the text the metric equivalents are shown only to the number of significant figures consistent with the accuracy of the value in inch-pound units.

| Inch-pound Unit (Multiply) | Inch-pound Abbreviation | (by) | Metric Unit (to obtain) | Metric Abbreviation |
|---|---|---|---|---|
| Acre-foot | acre-ft | 0.001233 | Cubic hectometer | $hm^3$ |
| Foot | ft | .3048 | Meter | m |
| Inch | in. | 25.40 | Millimeter | mm |
| Mile | mi | 1.609 | Kilometer | km |

Chemical concentration is given only in metric units—milligrams per liter (mg/L). For concentrations less than 7,000 mg/L, the numerical value is about the same as for concentrations in the inch-pound unit, parts per million.

# GROUND–WATER CONDITIONS IN UTAH, SPRING OF 1980

by

L. R. Herbert and others

U.S. Geological Survey

## INTRODUCTION

This is the seventeenth in a series of annual reports that describe ground-water conditions in Utah. Reports in the series, prepared cooperatively by the U.S. Geological Survey and the Utah Division of Water Resources, provide data to enable interested parties to keep abreast of changing ground-water conditions.

This report, like the others in the series, contains information on well construction, ground-water withdrawals, water-level changes, and related changes in precipitation and streamflow. Supplementary data such as graphs showing chemical quality of water and maps showing water-table configuration are included in reports of this series only for those years or areas for which applicable data are available and are important to a discussion of changing ground-water conditions.

The report includes individual discussions of selected major areas of ground-water withdrawal in the State for the calendar year 1979. Water-level fluctuations, however, are described for the period spring 1979 to spring 1980. Much of the data used in the report were collected by the Geological Survey in cooperation with the Division of Water Rights, Utah Department of Natural Resources.

The following reports dealing with ground water in the State were released by the Geological Survey during 1979:

Bedrock aquifers in the lower Dirty Devil River basin, Utah, with emphasis on the Navajo Sandstone, by J. W. Hood and T. W. Danielson, U.S. Geological Survey Open-File Report 79-1163 (pending publication as Utah Department of Natural Resources Technical Publication 68).

Hydrologic and climatologic data, southeastern Uinta Basin, Utah and Colorado, water year 1977, by Loretta S. Conroy, U.S. Geological Survey Open-File Report 79-1493 (duplicated as Utah Basic-Data Report 33).

Hydrologic evaluation of the Alton reclamation-study site, Alton coal field, Utah, by G. W. Sandberg, U.S. Geological Survey Open-File Report 79-346.

Hydrologic reconnaissance of the Wasatch Plateau-Book Cliffs coal-fields area, Utah, by K. M. Waddell and others, U.S. Geological Survey Open-File Report 79-988 (pending publication as a U.S. Geological Survey Water-Supply Paper).

Selected coal-related ground-water data, Wasatch Plateau-Book Cliffs area, Utah, by C. T. Sumsion, U.S. Geological Survey Open-File Report 79-915 (duplicated as Utah Basic-Data Report 32).

Summary appraisal of the water resources of the Great Basin, by Don Price, Rocky Mountain Association of Geologists and Utah Geological Association Guidebook, 1979, Basin and Range Symposium, p. 353-360.

Summary appraisals of the Nation's ground-water resources—Lower Colorado Region, by E. S. Davidson, U.S. Geological Survey Professional Paper 813-R.

## UTAH'S GROUND–WATER RESERVOIRS

Small quantities of ground water can be obtained from wells throughout much of Utah, but large supplies that are of suitable chemical quality for irrigation, public supply, or industrial use generally can be obtained only in specific areas. The major areas of ground-water development discussed in this report are shown in figure 1 and named in table 1. Only a few wells outside of these areas yield large supplies of water of good chemical quality for the uses listed above, although some of the basins in western Utah and many areas in eastern Utah have not been explored sufficiently to determine their potential for ground-water development.

About 2 percent of the wells in Utah obtain water from consolidated rocks. The consolidated rocks that yield the most water are lava flows, such as basalt, which contain interconnected vesicular openings or fractures; limestone, which contains fractures or other openings enlarged by solution; and sandstone, which contains open fractures. Most of the wells that tap consolidated rocks are in the eastern and southern parts of the State in areas where water supplies cannot be obtained readily from unconsolidated rocks.

About 98 percent of the wells in Utah draw water from unconsolidated rocks. These rocks may consist of boulders, gravel, sand, silt, or clay, or a mixture of some or all of these materials. Wells obtain the largest yields from the coarser materials that are sorted into deposits of uniform grain size. Most wells that tap unconsolidated rocks are in large intermountain basins, which have been partly filled with rock material eroded from the adjacent mountains.

## SUMMARY OF CONDITIONS

The estimated total withdrawal of water from wells in Utah in 1979 was about 860,000 acre-feet (1,060 $hm^3$)—about 31,000 acre-feet (38 $hm^3$) more than in 1978 and 73,000 acre-feet (90 $hm^3$) more than the average annual withdrawal during 1969-78 (table 2). The increase in withdrawal from the amount reported for 1978 was due primarily to increases in withdrawal for public supply. Total withdrawal for public supply in 1979 was about 162,000 acre-feet (200 $hm^3$) (table 2), which is 33,000 acre-feet (41 $hm^3$) more than reported for 1978. Withdrawal for irrigation was 567,000 acre-feet (699 $hm^3$), an increase of 5,000 acre-feet (6.1 $hm^3$).

The quantities of water withdrawn from wells are closely related to local climatic conditions. Precipitation in 1979 was below average in most of Utah (National Oceanic and Atmospheric Administration, 1980). Of the 33 stations for which graphs of cumulative departure from average annual precipitation are included in this report, 27 had below-average precipitation in 1979. This contributed most significantly to increased withdrawals from wells during 1979.

The below-average precipitation in most parts of the State during 1979 resulted in local reduction in ground-water recharge as well as increased withdrawals from wells. This in turn resulted in a general decline of ground-water levels in many parts of the State from spring of 1979 to spring of 1980. Notable exceptions where rises occurred were in areas where local above-average runoff contributed greatly to the recharge of the ground-water reservoir.

The total number of wells drilled during 1979 (table 2), as indicated by well-drillers' reports filed with the Utah Division of Water Rights, was about 35 percent less than reported for 1978. The number of those wells 6 inches (152 mm) or more in diameter drilled for public supply, irrigation, and industrial use was about 28 percent less than reported for 1978.

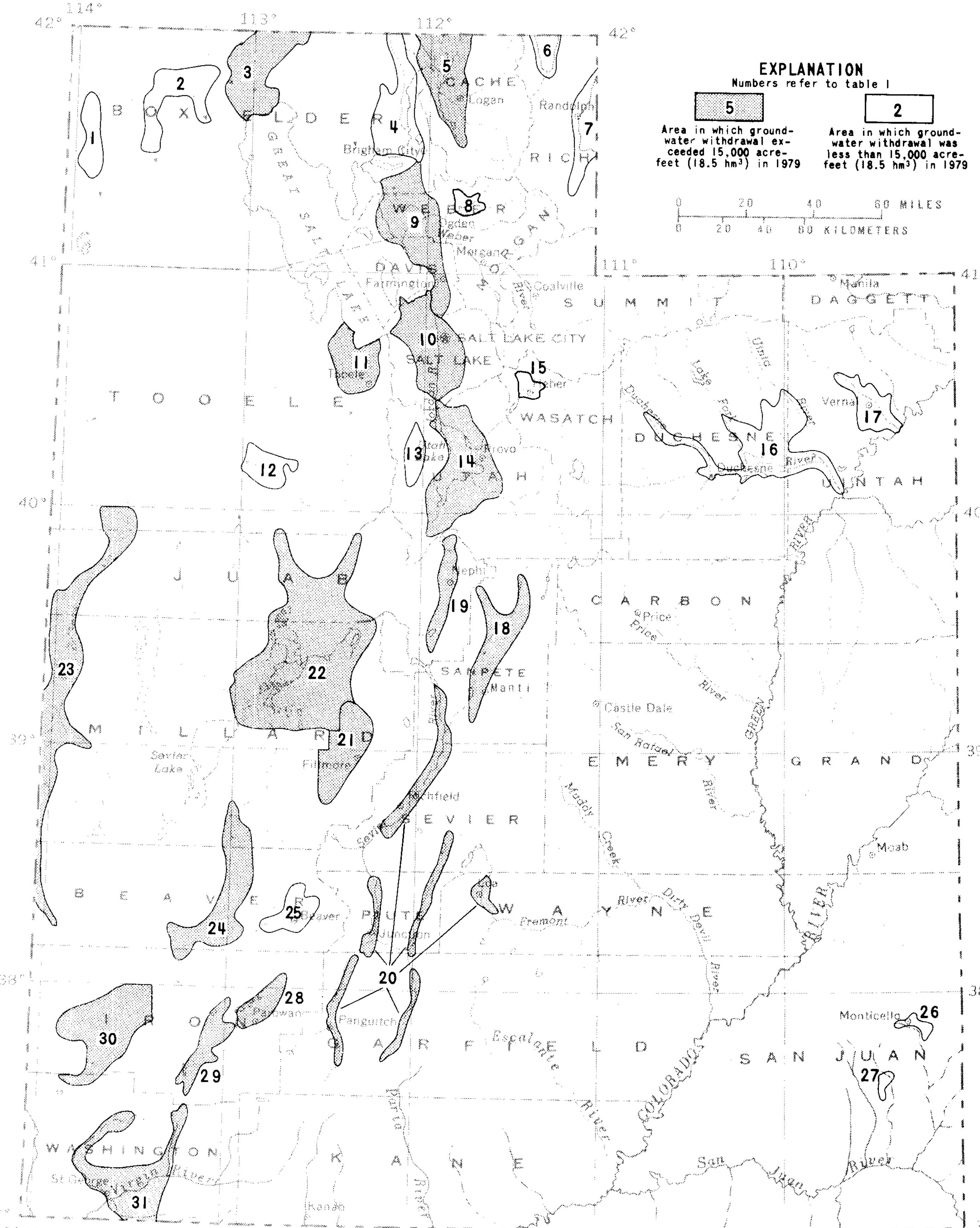



Figure 1.—Areas of ground-water development specifically referred to in this report.

Table 1.—Areas of ground-water development

| Number in figure 1 | Area | Principal type of water-bearing rocks |
|---|---|---|
| 1 | Grouse Creek valley | Unconsolidated |
| 2 | Park Valley | Do. |
| 3 | Curlew Valley | Unconsolidated and consolidated |
| 4 | Malad-lower Bear River valley | Unconsolidated |
| 5 | Cache Valley | Do. |
| 6 | Bear Lake valley | Do. |
| 7 | Upper Bear River valley | Do. |
| 8 | Ogden Valley | Do. |
| 9 | East Shore area | Do. |
| 10 | Jordan Valley | Do. |
| 11 | Tooele Valley | Do. |
| 12 | Dugway area | Do. |
| 13 | Cedar Valley | Do. |
| 14 | Utah and Goshen Valleys | Do. |
| 15 | Heber Valley | Do. |
| 16 | Duchesne River area | Unconsolidated and consolidated |
| 17 | Vernal area | Do. |
| 18 | Sanpete Valley | Unconsolidated |
| 19 | Juab Valley | Do. |
| 20 | Central Sevier Valley | Do. |
| | Upper Sevier Valleys | Do. |
| | Upper Fremont River valley | Unconsolidated and consolidated |
| 21 | Pavant Valley | Unconsolidated |
| 22 | Sevier Desert | Do. |
| 23 | Snake Valley | Do. |
| 24 | Milford area | Do. |
| 25 | Beaver Valley | Do. |
| 26 | Monticello area | Do. |
| 27 | Blanding area | Do. |
| 28 | Parowan Valley | Unconsolidated and consolidated |
| 29 | Cedar City Valley | Unconsolidated |
| 30 | Beryl-Enterprise area | Do. |
| 31 | Central Virgin River area | Unconsolidated and consolidated |

Table 2.—Well construction and withdrawal of water from wells in Utah

| Area | Number in figure 1 | Number of wells completed in 1979[1]: Total | Number of wells completed in 1979[1]: 6 inches or more[2] | Estimated withdrawal from wells (acre-feet): 1979 Irrigation | 1979 Industry | 1979 Public supply | 1979 Domestic and stock | 1979 Total (rounded) | 1978 total[3] | 1969-78 average annual[4] |
|---|---|---|---|---|---|---|---|---|---|---|
| Cache Valley | 5 | 56 | 5 | 14,000 | 9,000[5] | 3,000 | 2,100 | 28,000 | 26,000 | 26,000 |
| East Shore area | 9 | 36 | 2 | 14,500[6] | 6,200 | 29,900 | – | 51,000 | 40,000 | 42,000 |
| Jordan Valley | 10 | 79 | 16 | 3,500 | 36,200[7] | 62,900 | 33,000[5] | 136,000 | 127,000 | 121,000 |
| Tooele Valley | 11 | 13 | 2 | 24,600[6] | 500 | 4,500 | 150 | 30,000 | 30,000 | 28,000 |
| Utah and Goshen Valleys | 14 | 121 | 2 | 58,800 | 11,200 | 25,600 | 12,700[8] | 108,000 | 106,000 | 96,000 |
| Juab Valley | 19 | 18 | 4 | 20,800 | 50 | 670 | 200 | 21,000 | 19,000 | 24,000 |
| Sevier Desert | 22 | 34 | 3 | 41,200 | 2,000 | 800 | 900 | 45,000 | 39,000 | 29,000 |
| Sanpete Valley | 18 | 24 | 4 | 13,300 | 1,000 | 1,500 | 3,500[8] | 19,000 | 26,000 | 20,000 |
| Upper and central Sevier Valleys and upper Fremont River valley[9] | 20 | 50 | 0 | 16,200 | 100 | 2,800 | 5,300 | 24,000 | 26,000 | 22,000 |
| Pavant Valley | 21 | 7 | 1 | 84,700 | 100 | 600 | 300 | 86,000 | 88,000 | 89,000 |
| Cedar City Valley | 29 | 4 | 1 | 27,900[10] | 900 | 2,900 | 400 | 32,000 | 31,000 | 33,000 |
| Parowan Valley | 28 | 1 | 1 | 28,600[10,11] | 350 | 500 | 150 | 30,000 | 29,000 | 28,000 |
| Escalante Valley | | | | | | | | | | |
| Milford area | 24 | 5 | 0 | 47,800[12] | 0 | 1,000 | 300 | 49,000 | 58,000 | 60,000 |
| Beryl-Enterprise area | 30 | 8 | 2 | 77,400[10] | 0 | 370 | 750 | 79,000 | 71,000 | 79,000 |
| Other areas[13] | | 463 | 77 | 93,500 | 3,000 | 24,500 | 1,300 | 122,000 | 113,000 | 90,000 |
| Totals (rounded) | | 919 | 120 | 567,000 | 71,000 | 162,000 | 61,000 | 860,000 | 829,000 | 787,000 |

[1] Compiled from data supplied by Utah Department of Natural Resources, Division of Water Rights. Includes deepened and replacement wells.
[2] Constructed for irrigation, industry, or public supply.
[3] From Price and others (1979, p. 4).
[4] Calculated from previous reports of this series. Some figures include unpublished revisions.
[5] Includes some use for fish and fur culture.
[6] Includes some domestic and stock use.
[7] Includes some use for air conditioning.
[8] Includes some use for irrigation.
[9] Upper Fremont River valley included in "Other areas" prior to 1976.
[10] Data from reports of local water commissioners to the Utah Department of Natural Resources, Division of Water Rights.
[11] Includes some use for stock.
[12] Data from the Milford Water Commissioner.
[13] Withdrawals are estimated minimum amounts.

**Table 3.—Total annual withdrawal of water from wells in major areas of ground-water development in Utah, 1969-78**
(From previous reports in this series)

| Area | Number in figure 1 | Thousands of acre-feet | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1969 | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 |
| Cache Valley | 5 | 26 | 25 | 24 | 23 | 24 | 24 | 25 | 27 | 32 | 26 |
| East Shore area | 9 | 38 | 39 | 41 | 41 | 42 | 50 | 41 | 41 | 52 | 40 |
| Jordan Valley | 10 | 109 | 109 | 116 | 124 | 129 | 130 | 122 | 124 | 119 | 127 |
| Tooele Valley | 11 | 23 | 25 | 24 | 29 | 29 | 33 | 29 | 30 | 28 | 30 |
| Utah and Goshen Valleys | 14 | 78 | 83 | 86 | 91 | 89 | 106 | 98 | 107 | 118 | 106 |
| Juab Valley | 19 | 18 | 18 | 21 | 30 | 17 | 31 | 25 | 29 | 29 | 19 |
| Sevier Desert | 22 | 21 | 16 | 17 | 40 | 22 | 25 | 26 | 33 | 50 | 39 |
| Sanpete Valley | 18 | 15 | 14 | 16 | 20 | 16 | 17 | 15 | 25 | 36 | 26 |
| Upper and central Sevier Valleys and upper Fremont River valley | 20 | 20 | 19 | 19 | 19 | 19 | 20 | 24 | 25 | 26 | 26 |
| Pavant Valley | 21 | 75 | 71 | 79 | 99 | 69 | 101 | 98 | 95 | 117 | 88 |
| Cedar City Valley | 29 | 27 | 31 | 36 | 35 | 27 | 42 | 28 | 37 | 40 | 31 |
| Parowan Valley | 28 | 20 | 26 | 24 | 28 | 26 | 31 | 28 | 34 | 33 | 29 |
| Escalante Valley | | | | | | | | | | | |
| Milford area | 24 | 52 | 56 | 58 | 59 | 52 | 70 | 60 | 65 | 65 | 58 |
| Beryl-Enterprise area | 30 | 84 | 70 | 75 | 77 | 74 | 93 | 85 | 79 | 81 | 71 |
| Other areas | | 56 | 72 | 75 | 80 | 79 | 106 | 85 | 108 | 121 | 113 |
| Totals (rounded) | | 660 | 670 | 710 | 800 | 710 | 880 | 790 | 860 | 947 | 829 |

The larger ground-water basins and those containing most of the ground-water development in Utah are shown in figure 1. Table 2 gives information about the number of wells constructed, withdrawals of water from wells for principal uses, and total withdrawals in 1979 for selected major ground-water basins. For comparison, total withdrawals in 1978 and average annual withdrawals during the 10-year period 1969-78 are also shown. Table 3 shows the annual withdrawals from the major basins for the period 1969-78.

## MAJOR AREAS OF GROUND–WATER DEVELOPMENT

### CACHE VALLEY

by R. B. Garrett

Approximately 28,000 acre-feet (35 $hm^3$) of water was withdrawn from wells in Cache Valley during 1979. This was 2,000 acre-feet (2.5 $hm^3$) more than the amount withdrawn in 1978 and 2,000 acre-feet (2.5 $hm^3$) more than the average annual withdrawal for the previous 10 years, 1969-78 (table 2). The increase was due to below-average precipitation and below-average surface-water supplies for irrigation. Discharge of the Logan River during 1979 was 149,800 acre-feet (185 $hm^3$), which is 83 percent of the 1941-79 average.

Water levels declined as much as 2 feet (0.6 m) in the southern two-thirds of Cache Valley and rose as much as 5 feet (1.5 m) in the northern third of the valley from March 1979 to March 1980 (fig. 2).

The long-term trend of the water levels in well (A-12-1)29cab-1, the annual discharge of the Logan River near Logan, and the cumulative departure from the average annual precipitation at Logan Utah State University are shown for comparison in figure 3 along with annual withdrawals from wells. Precipitation at Logan Utah State University during 1979 was 4.86 inches (123 mm) below the 1941-79 annual average. This resulted in below-average streamflow and increased ground-water withdrawal in most of the valley. The below-average streamflow and precipitation resulted in below-average recharge; this and the increased withdrawals are reflected in the decline of water levels in well (A-12-1)29cab-1.

### EAST SHORE AREA

by L. R. Herbert

The withdrawal of water from wells in the East Shore area in 1979 was about 51,000 acre-feet (63 $hm^3$), 11,000 acre-feet (14 $hm^3$) more than the amount reported for 1978 and 9,000 acre-feet (11 $hm^3$) more than the 1969-78 annual average (table 2). The increase was due mainly to withdrawals for public supply.

Water levels declined from March 1979 to March 1980 in most of the East Shore area (fig. 4). The declines were due to increased withdrawals from public-supply wells and below-average precipitation during 1979.

The long-term relation of water levels in selected wells to precipitation at Ogden Pioneer powerhouse and withdrawals from wells is shown in figure 5. The annual precipitation of 19.32 inches (491 mm) for 1979 was 1.48 inches (38 mm) below the 1937-79 average. The below-average precipitation is reflected by a decline of water levels in three of the four observation wells for which hydrographs are shown.

## JORDAN VALLEY

by E. C. Gerhart

Withdrawal of water from wells in the Jordan Valley in 1979 was 136,000 acre-feet (168 $hm^3$), 9,000 acre-feet (11 $hm^3$) more than the amount reported for 1978 and 15,000 acre-feet (18 $hm^3$) more than the annual average for 1969-78 (table 2). Withdrawals in 1979 for irrigation and industrial use decreased by about 8 and 14 percent, respectively, from the previous year, and withdrawals for domestic and stock use remained unchanged. Withdrawals for public supply, however, increased by about 29 percent due to increased population (fig. 6) and below-normal precipitation.

Water levels in the Jordan Valley during the period February 1979 to February 1980 showed a net decline of 0.4 foot (0.1 m). Water levels declined in about 67 percent of the valley and rose in about 33 percent (fig. 7). The largest observed declines were 7 feet (2.1 m) in a well near the northern part of Salt Lake City and about 6 feet (1.8 m) in a well in the Sandy area. Both declines were due to increased withdrawal for public supply. The largest rise in water level, which was 11.5 feet (3.5 m) in a well about 3 miles (4.9 km) south of Riverton, was probably caused by decreased withdrawals for irrigation and local recharge from canals.

The relation between water levels in selected wells and precipitation is shown in figure 8. Precipitation at Silver Lake Brighton during 1979 was 11.74 inches (298 mm) below the average for 1931-79. The below-average precipitation and the resultant increase in withdrawals from wells is reflected in a decline of water levels in four of the five observation wells.

## TOOELE VALLEY

by Judy I. Steiger

Withdrawal of water from wells in Tooele Valley during 1979 was approximately 30,000 acre-feet (37 $hm^3$). This is the same as reported for 1978 but 2,000 acre-feet (2.5 $hm^3$) more than the average annual withdrawal for the previous 10 years (table 2).

The discharge from springs in 1979 was approximately 15,000 acre-feet (18 $hm^3$), which is 1,000 acre-feet (1.2 $hm^3$) less than reported for 1978. About 2,000 acre-feet (2.5 $hm^3$) of the spring discharge was used for irrigation and stock in Tooele Valley, and about 13,000 acre-feet (16 $hm^3$) was diverted to the Jordan Valley for industrial use.

Water levels declined in most of the valley from March 1979 to March 1980, with declines of 2-4 feet (0.6-1.2 m) occurring along the eastern edge of the valley (fig. 9). Declines were probably due to below-average precipitation.

The relation of water levels in selected observation wells to precipitation at Tooele and annual withdrawal from wells is shown in figure 10. Water levels declined in four of the observation wells, rose in one, and remained the same in one. Precipitation at Tooele in 1978 was 68 percent of the 1936-79 annual average.

## UTAH AND GOSHEN VALLEYS

by Cynthia L. Appel

Withdrawal of water from wells in Utah and Goshen Valleys in 1979 was about 108,000 acre-feet (133 $hm^3$). This was 2,000 acre-feet (2.5 $hm^3$) more than reported in 1978 and 12,000 acre-feet (15 $hm^3$) more than the 1969-78 annual average (table 2). Withdrawal for public supply was 1,300 acre-feet (1.6 $hm^3$) less than reported in 1978. Withdrawal for irrigation and industry increased by 2,800 acre-feet (3.5 $hm^3$) and 1,000 acre-feet (1.2 $hm^3$), respectively (table 2). The increase in withdrawals may be attributed to below-average precipitation (fig. 15) and runoff during 1979. In Utah Valley, 89,000 acre-feet (110 $hm^3$) of water was withdrawn in 1979, or 3,100 acre-feet (3.8 $hm^3$) more than in 1978. In Goshen Valley, 19,400 acre-feet (24 $hm^3$) of water was withdrawn in 1979, or about 500 acre-feet (0.6 $hm^3$) less than in 1978.

Water levels in most observation wells declined from March 1979 to March 1980 (figs. 11-15). The general decline was probably due to increased ground-water withdrawal and below-average precipitation. Water levels rose in some wells, however, due to less ground-water withdrawal in localized areas and increased recharge from precipitation and runoff during January-February 1980.

The relation of water levels in three observation wells to precipitation at Alpine and Spanish Fork powerhouse and annual withdrawals from wells is shown in figure 15.

## JUAB VALLEY

by V. L. Jensen

Withdrawal of water from wells in Juab Valley during 1979 was about 21,000 acre-feet (26 $hm^3$), an increase of 2,000 acre-feet (2.5 $hm^3$) from the amount reported for 1978 but 3,000 acre-feet (3.7 $hm^3$) less than the 1969-78 average (table 2). The increase in withdrawals was due to below-average precipitation and the resultant decrease in surface water available for irrigation.

From March 1979 to March 1980, water levels rose by as much as 4 feet (1.2 m) except in heavily pumped areas near Levan, Nephi, and Mona where declines of up to 2 feet (0.6 m) were observed (fig. 16). The rise in water levels is probably due to below-average withdrawals both in 1978 and 1979.

The relation of water levels in two observation wells to cumulative departure from the 1935-79 average annual precipitation at Nephi and annual withdrawals is shown in figure 17. Precipitation at Nephi during 1979 was 12.13 inches (308 mm) or 1.4 inches (36 mm) below the 1935-79 average.

## SEVIER DESERT

by Michael Enright

Withdrawal of water from wells in the Sevier Desert in 1979 was about 45,000 acre-feet (55 $hm^3$), which was 6,000 acre-feet (7.4 $hm^3$) more than was reported for 1978 and about 16,000 acre-feet (20 $hm^3$) more than the annual average withdrawal for the previous 10 years, 1969-78 (table 2). The increase from 1978 to 1979 was partly due to a less abundant surface-water supply for irrigation. During 1979, the Sevier River near Juab discharged 125,700 acre-feet (155 $hm^3$) (fig. 20). This was 300 acre-feet (0.14 $hm^3$) less than the 1978 discharge and about 14,170 acre-feet (17 $hm^3$) less than the average discharge for 1935-79.

In those parts of the Sevier Desert where observation wells are located, water levels declined from March 1979 to March 1980 in over 67 percent of the lower artesian aquifer and in over 74 percent of the upper artesian aquifer (figs. 18 and 19). The largest water-level decline in the lower artesian aquifer was 8.6 feet (2.6 m) 1 mile (1.6 km) south of Delta. The largest observed decline in the upper artesian aquifer was 6.6 feet (2.0 m) about 1.5 miles (2.4 km) south of Delta. Observed water-level rises in the lower artesian aquifer were all less than 1 foot (0.3 m) with the exception of a 3-foot (0.9 m) rise in well (C-13-3)16ddd-1, about 3 miles (4.8 km) north of the Gilson Mountains. The largest observed rise in the upper artesian aquifer was 0.9 foot (0.3 m) about 12 miles (19 km) west of Delta.

The long-term relation of precipitation at Oak City to discharge of the Sevier River near Juab, water levels in selected wells, and annual withdrawals from wells is shown in figure 20. Precipitation at Oak City in 1979 was 0.84 inch (21 mm) below the 1935-79 annual average. The water levels declined in the selected observation wells because of continued large ground-water withdrawals.

## SANPETE VALLEY

by S. K. Dubois

Approximately 19,000 acre-feet (23 $hm^3$) of water was withdrawn from wells in Sanpete Valley during 1979. This was 7,000 acre-feet (8.6 $hm^3$) less than the amount withdrawn in 1978 and 1,000 acre-feet (1.2 $hm^3$) less than the average annual withdrawal for the period 1969-78 (table 2). The decreased withdrawal from wells during 1979 was due to the increased amount of surface water available for irrigation.

Water levels rose in most of Sanpete Valley from March 1979 to March 1980 (fig. 21). A rise of about 11 feet (3.3 m) was measured near Manti and rises of almost 6 feet (1.8 m) were measured near Ephraim, Mount Pleasant, and Milburn. Local declines of generally less than 3 feet (0.9 m) were observed near Nine Mile Reservoir, south of Wales, at Spring City, and southeast of Fairview. These declines may have been due to reduced irrigation of nearby lands with surface water, resulting in reduced recharge from the irrigated areas.

Long-term hydrographs of water levels in three wells in Sanpete Valley, the long-term trend of precipitation at Manti, and annual withdrawals from wells are shown in figure 22. The water-level rises in all three observation wells as well as the general water-level rise in the valley may be due to the reduced withdrawal from wells or to increased recharge from precipitation and runoff during January-February 1980.

## UPPER AND CENTRAL SEVIER VALLEYS AND UPPER FREMONT RIVER VALLEY

by D. C. Emett

Withdrawal of water from wells in the upper and central Sevier Valleys and upper Fremont River valley was approximately 24,000 acre-feet (30 $hm^3$) in 1979. This was 2,000 acre-feet (2.5 $hm^3$) less than reported in 1978 but about 2,000 acre-feet (2.5 $hm^3$) more than the 1969-78 annual average (table 2). Withdrawals for irrigation and domestic and stock use decreased during 1979 due to above-average streamflow.

Water levels rose in most of the upper and central Sevier Valleys and upper Fremont River valley from March 1979 to March 1980 (fig. 23). Rises of up to 9 feet (2.7 m) were measured in wells near the Sevier River, and local declines of up to 7 feet (2.1 m) were measured in wells near the Fremont River. The rises are probably due to above-average discharge of the Sevier River, and the declines are probably due to below-average discharge of the Fremont River.

The relation of water levels in selected wells to discharge of the Sevier River at Hatch, to precipitation at Panguitch, Salina, and Loa, and to annual withdrawals from wells is shown in figure 24. Although the precipitation at the three sites was below average, water levels rose in two of the three observation wells for which hydrographs are shown in figure 24, probably reflecting the decrease of withdrawals from wells from 1978 to 1979.

## PAVANT VALLEY

by A. I. Guhman

Withdrawal of water from wells in Pavant Valley in 1979 was 86,000 acre-feet (106 $hm^3$), which was 2,000 acre-feet (2.5 $hm^3$) less than reported for 1978 and 3,000 acre-feet (3.7 $hm^3$) less than the 1969-78 annual average (table 2). The decrease in withdrawals may have been due to an increase in the use of sprinkler irrigation systems.

Water levels rose from March 1979 to March 1980 in about 47 percent of the wells measured and declined in 53 percent. Areas of rises and declines are shown in figure 25. The maximum observed rise was 13.4 feet (4.1 m) in a well west of Holden, and the largest decline was 13.3 feet (4.1 m) in a well north of McCornick.

The relation of water levels in selected wells to withdrawals from wells and cumulative departure from average annual precipitation at Fillmore is shown in figure 26. Water levels declined in two of the observation wells and rose in five. Precipitation was slightly below average in 1979.

Figure 27 shows variations of dissolved-solids concentrations in water from selected wells in Pavant Valley. In 1979, the concentrations increased in water from two of four wells sampled and decreased in water from the other two. The concentration of dissolved solids in 1979, compared to the most recent preceding measurement was less in wells (C-23-6)8abd-1 and (C-21-5)7cdd-3 and more in wells (C-23-5)5acd-1 and (C-23-6)21bdd-1.

## CEDAR CITY VALLEY

by L. J. Neff

Withdrawal of water from wells in Cedar City Valley during 1979 was approximately 32,000 acre-feet (39 $hm^3$), an increase of 1,000 acre-feet (1.2 $hm^3$) from the amount reported in 1978, but 1,000 acre-feet (1.2 $hm^3$) less than the average annual withdrawal for the previous 10 years (table 2). The increase in withdrawal was probably due to below-average precipitation during 1979 and increased requirements for public supply.

Water levels rose as much as 11 feet (3.3 m) in Cedar City Valley except in the northern part where declines of up to 3 ft (0.9 m) were observed (fig. 28). The largest rise occurred at the mouth of Coal Creek in response to the above-average discharge of the creek. The magnitude of the rise decreased in all directions away from Coal Creek. In the northern part of the valley, declines of up to 3 feet (0.9 m), resulted from withdrawals for irrigation. Figure 29 shows water levels in well (C-35-11)33aac-1, cumulative departure from average annual precipitation at Cedar City, discharge from Coal Creek, and average annual withdrawals from wells in Cedar City Valley. The water-level rise in well (C-35-11)33aac-1 reflects the above-average discharge of Coal Creek.

## PAROWAN VALLEY

by L. G. Sultz

Withdrawal of water from wells in Parowan Valley was about 30,000 acre-feet (37 $hm^3$) in 1979. This was 1,000 acre-feet (1.2 $hm^3$) more than reported for 1978 and 2,000 acre-feet (2.5 $hm^3$) more than the 1969-78 average annual withdrawal (table 2). Withdrawals for irrigation, public supply, and industry increased, while withdrawals for domestic and stock use were the same as reported for 1978.

Water levels in the northern part of the valley declined from March 1979 to March 1980 (fig. 30) due to increased withdrawals. Water levels in the southern part generally rose due to increased surface-water supplies and local decreased withdrawals from wells.

The relation of water levels in well (C-34-8)5bca-1 to annual withdrawals from wells and cumulative departure from the average annual precipitation at Parowan Airport is shown in figure 31. The water level in well (C-34-8)5bca-1 continued to decline in 1979 for the fifth straight year due to below-average precipitation and large withdrawals from wells.

## ESCALANTE VALLEY

### Milford area

by G. W. Sandberg

Withdrawal of water from wells in the Milford area in 1979 was about 49,000 acre-feet (60 $hm^3$)—9,000 acre-feet (11 $hm^3$) less than was reported for 1978 and 11,000 acre-feet (14 $hm^3$) less than the average annual withdrawal for the previous 10 years, 1969-78 (table 2). The decrease was probably the result of more surface water being available for irrigation in the southern part of the area, increased use of sprinkler-irrigation systems, and better water management because of the increased cost of pumping.

From March 1979 to March 1980 water levels generally declined less than 1 foot (0.3 m) in most of the area (fig. 32) owing to below-average precipitation. In the heavily pumped area between Minersville and Milford, however, water levels rose as much as 7 feet (2.1 m) as a result of decreased pumping and increased recharge from the Beaver River. The river channel is usually dry north of Minersville, but in the spring of 1979 the streamflow extended to within about 5 miles (8.0 km) of Milford.

The relation of water levels in well (C-29-10)6ddc-2 to precipitation at Milford Airport, discharge of the Beaver River at Rocky Ford Dam near Minersville, and annual withdrawals from wells is shown in figure 33. The water-level rise in well (C-29-10)6ddc-2 reflects reduced withdrawals from wells and increased recharge from the Beaver River.

## ESCALANTE VALLEY

### Beryl-Enterprise area

by G. W. Sandberg

Withdrawal of water from wells in the Beryl-Enterprise area in 1979 was about 79,000 acre-feet (97 $hm^3$), an increase of 8,000 acre-feet (10 $hm^3$) from the amount reported for 1978 and the same as the average annual withdrawal for the previous 10 years, 1969-78 (table 2). The increase was due to below-average precipitation during the summer resulting in larger withdrawals for irrigation. Much of the precipitation fell during the early spring of 1979, causing extensive flooding in the southern part of the area. This resulted in water-level rises but contributed little to the surface-water supply for irrigation.

Water levels rose near Enterprise (fig. 34) as a result of above-average precipitation in the early spring of 1979 and flooding of Shoal, Mountain Meadow, and Pinto Creeks in the winter of 1980. The largest recorded rise was 29 feet (8.8 m) in a well about 1 mile (1.6 km) northeast of Enterprise. Water levels in this well rose about 55 feet (17 m) since March of 1978. Water levels in most of the northern part of the area and a small area southwest of Newcastle declined less than 1 foot (0.3 m) from March 1979 to March 1980. Declines of as much as 3 feet (0.9 m) occurred in an area about 7 miles (11 km) north of Newcastle (fig. 34).

The relation of the water level in well (C-35-17)25dcd-1 to precipitation at Modena and withdrawal from wells is shown in figure 35. The water level in this well rose for the first time since 1971, and it was the largest such rise since 1962.

Figure 36 shows changes in concentrations of dissolved solids in the water from three wells in the Beryl-Enterprise area. The concentrations decreased in the southern and central part of the area because of recharge from surface water of better quality than the ground water. The concentration decreased slightly in the northern part of the area possibly because more land is irrigated by sprinklers, which resulted in a reduction of seepage with salts leached from the soil to the ground-water reservoir.

## OTHER AREAS

by L. R. Herbert

Approximately 122,000 acre-feet (150 $hm^3$) of water was withdrawn from wells in those areas of Utah listed below:

| Number in figure 1 | | Estimated withdrawal (acre-feet) |
|---|---|---|
| 1 | Grouse Creek valley | 3,000 |
| 2 | Park Valley | 2,600 |
| 3 | Curlew Valley | 25,700 |
| 8 | Ogden Valley | 10,700 |
| 12 | Dugway area (including Skull Valley north of area outlined in fig. 1) | 4,400 |
| 13 | Cedar Valley | 4,400 |
| 23 | Snake Valley | 15,700 |
| 25 | Beaver Valley | 11,400 |
| 31 | Central Virgin River area | 19,900 |
| | Remainder of State | 24,500 |
| | Total (rounded) | 122,000 |

The total withdrawal was 9,000 acre-feet (11 $hm^3$) more than the amount reported for 1978 and 32,000 acre-feet (39 $hm^3$) more than the 1969-78 annual average (table 2). The increase in withdrawals from wells in 1979 was due to below-average precipitation in some of the areas, which resulted in decreased surface-water supplies for irrigation and other uses.

Figure 37 shows the relation between long-term hydrographs of observation wells in selected areas and cumulative departure from average annual precipitation at sites in or near those areas. Water levels declined in most of the wells from March 1979 to March 1980. The declines were the result of increased withdrawals of ground water and below-average precipitation. Water levels rose in some wells due to local above-average precipitation and decreased local withdrawal from wells. Water levels generally rose in Cedar Valley (fig. 38) and generally declined in the more heavily pumped parts of Curlew Valley (fig. 39) from March 1979 to March 1980.

## REFERENCES CITED

National Oceanic and Atmospheric Administration, Environmental Data Service, 1980, Climatological data (annual summary, 1979): v. 79, no. 13.

Price, Don, and others, 1979, Ground-water conditions in Utah, spring of 1979: Utah Division of Water Resources Cooperative Investigations Report 18, 68 p.

## ILLUSTRATIONS

On all maps showing changes in water levels, areas of water-level rise are indicated by dotted patterns, and areas of water-level decline are indicated by lined patterns

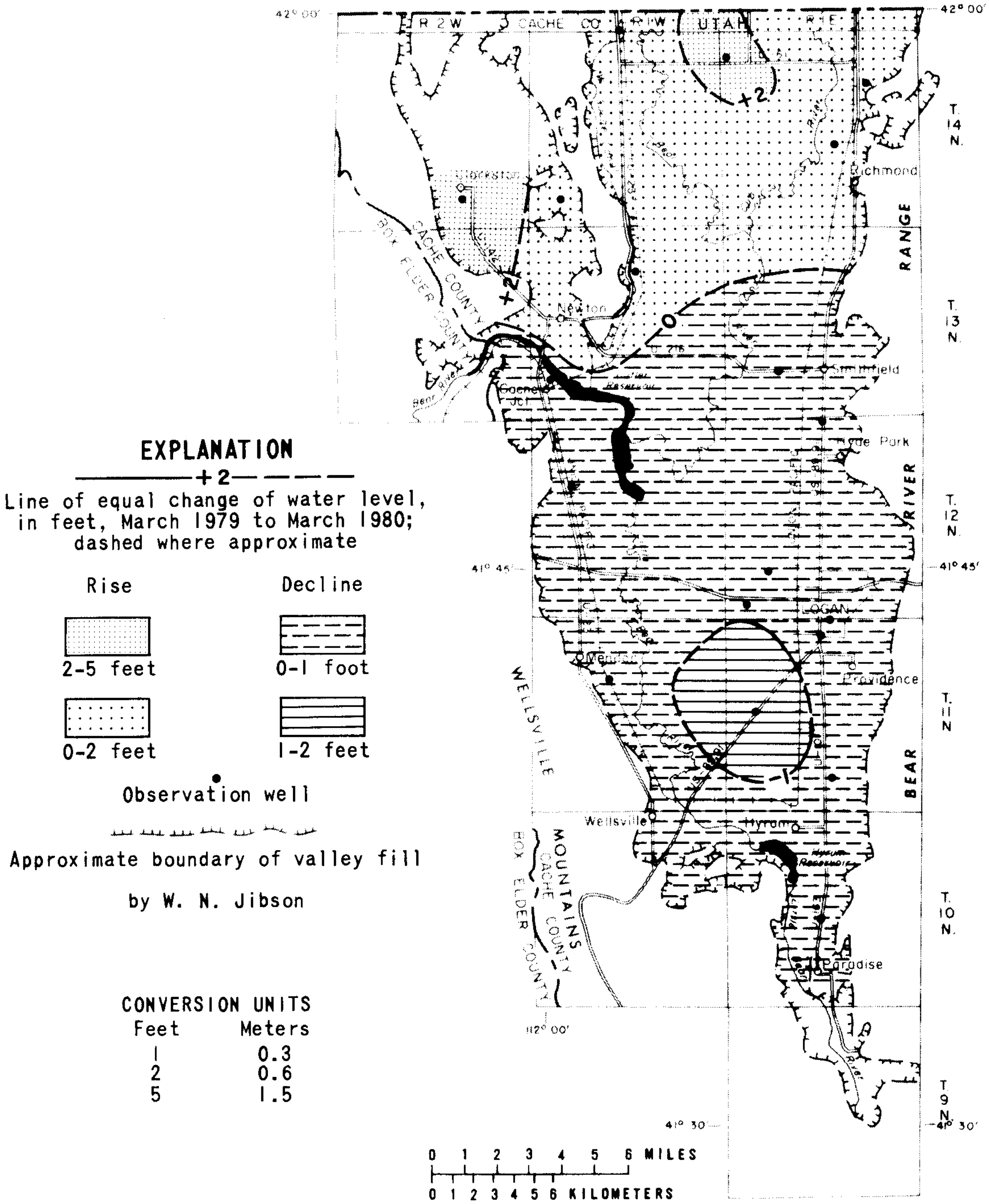



Figure 2.—Map of Cache Valley showing change of water levels from March 1979 to March 1980.

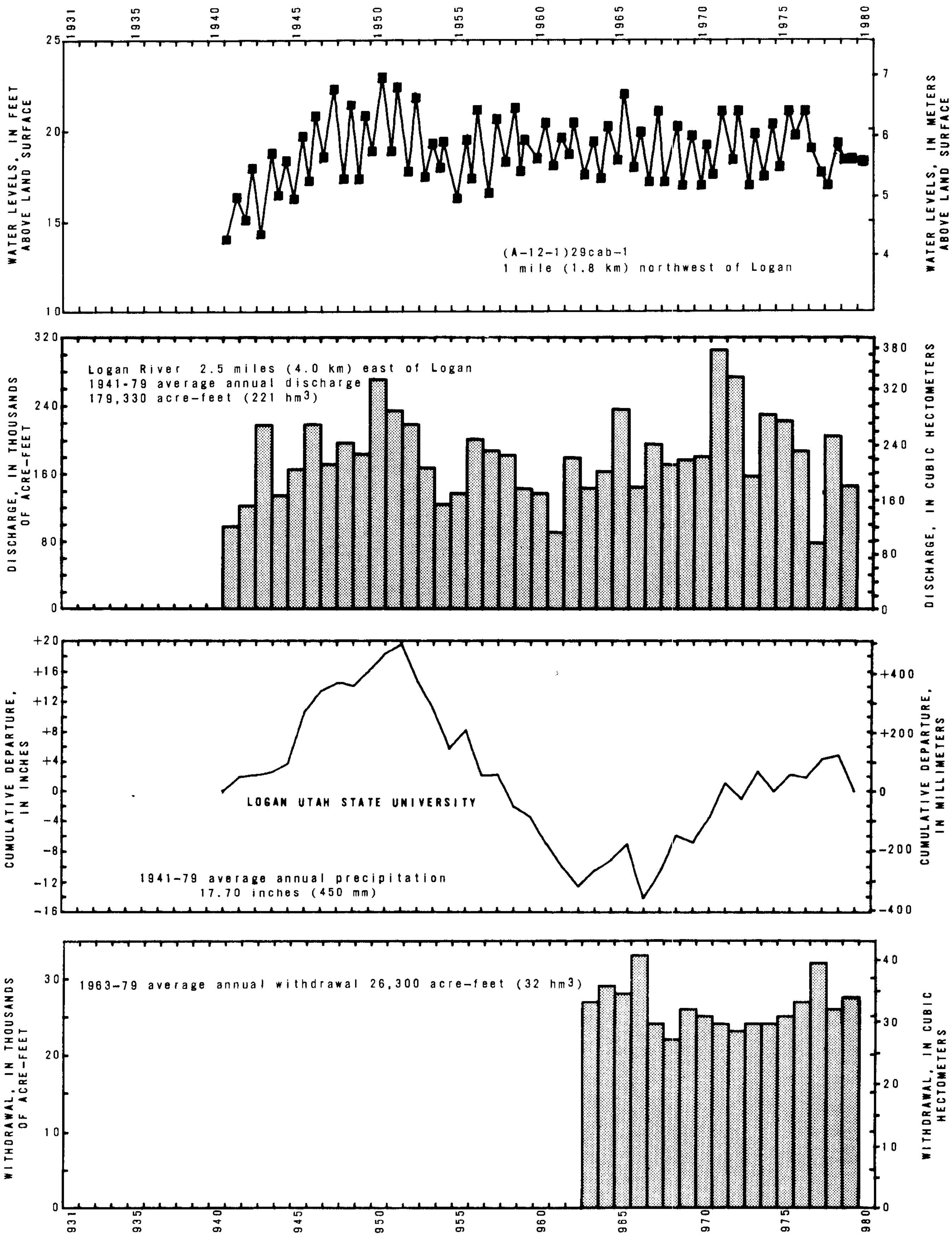



Figure 3.—Relation of water levels in well (A-12-1)29cab-1 in Cache Valley to discharge of the Logan River near Logan, to cumulative departure from the average annual precipitation at Logan Utah State University, and to annual withdrawals from wells.

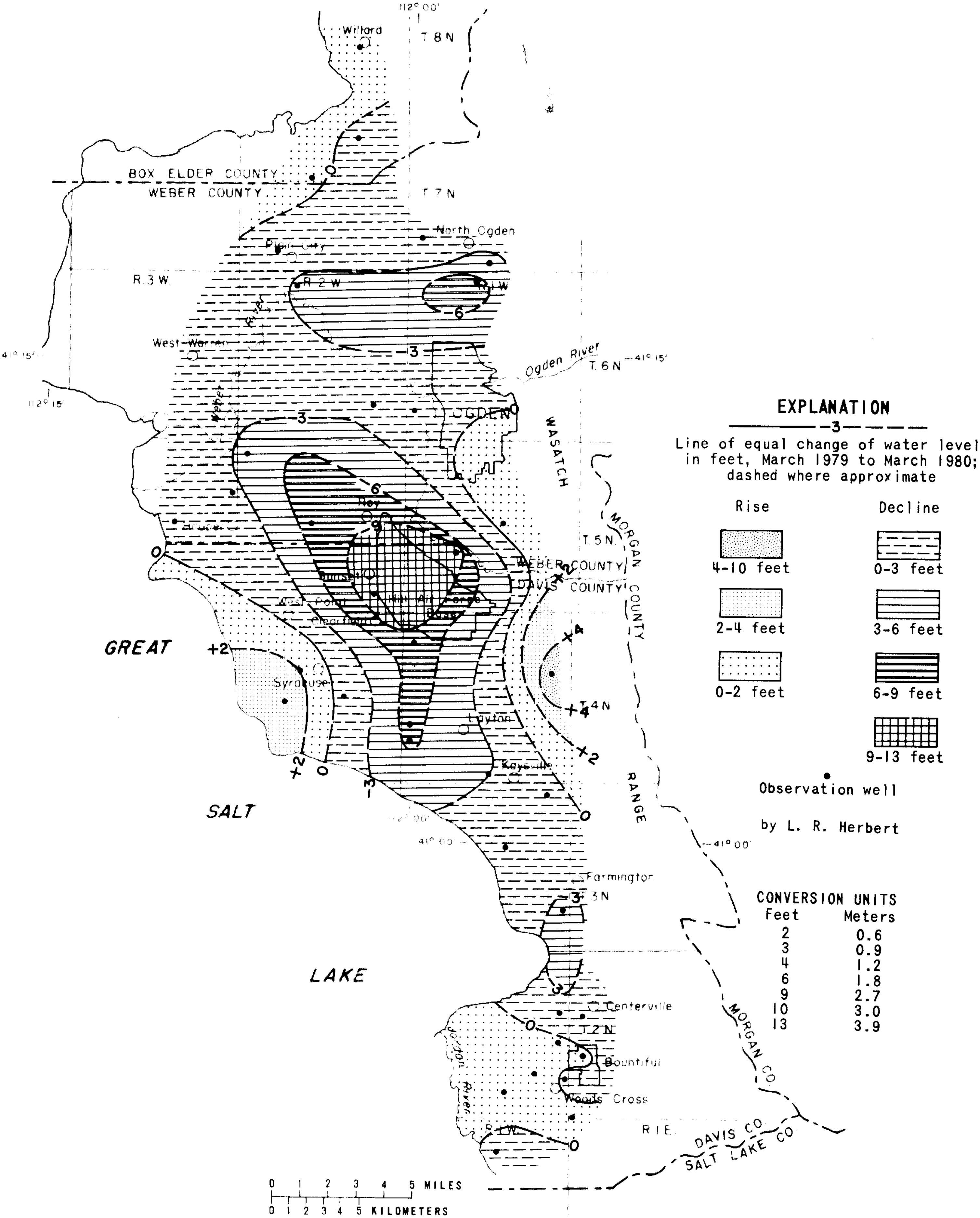



Figure 4.—Map of the East Shore area showing change of water levels from March 1979 to March 1980.

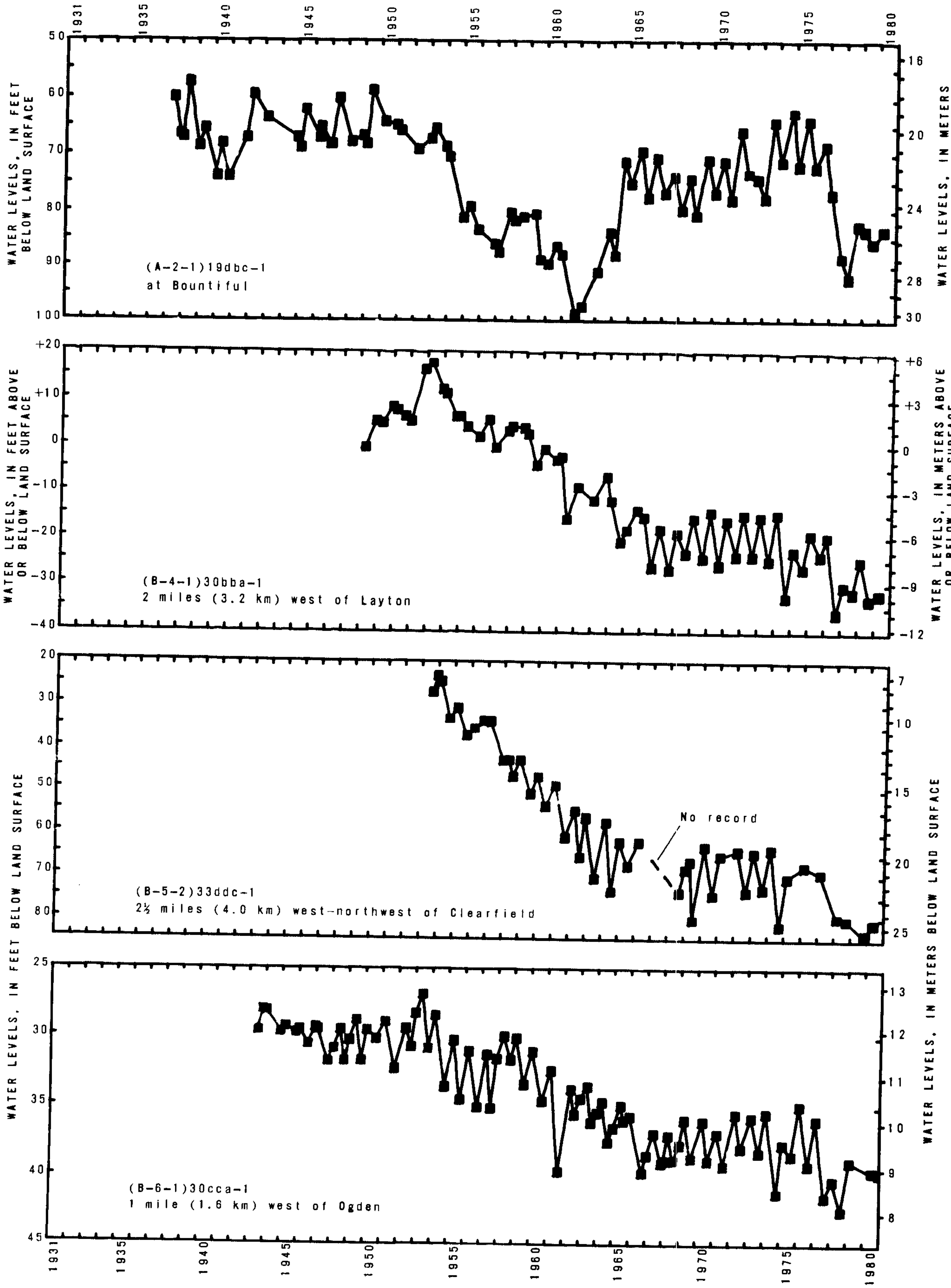



Figure 5.—Relation of water levels in selected wells in the East Shore area to cumulative departure from the average annual precipitation at Ogden Pioneer powerhouse and to annual withdrawals from wells.

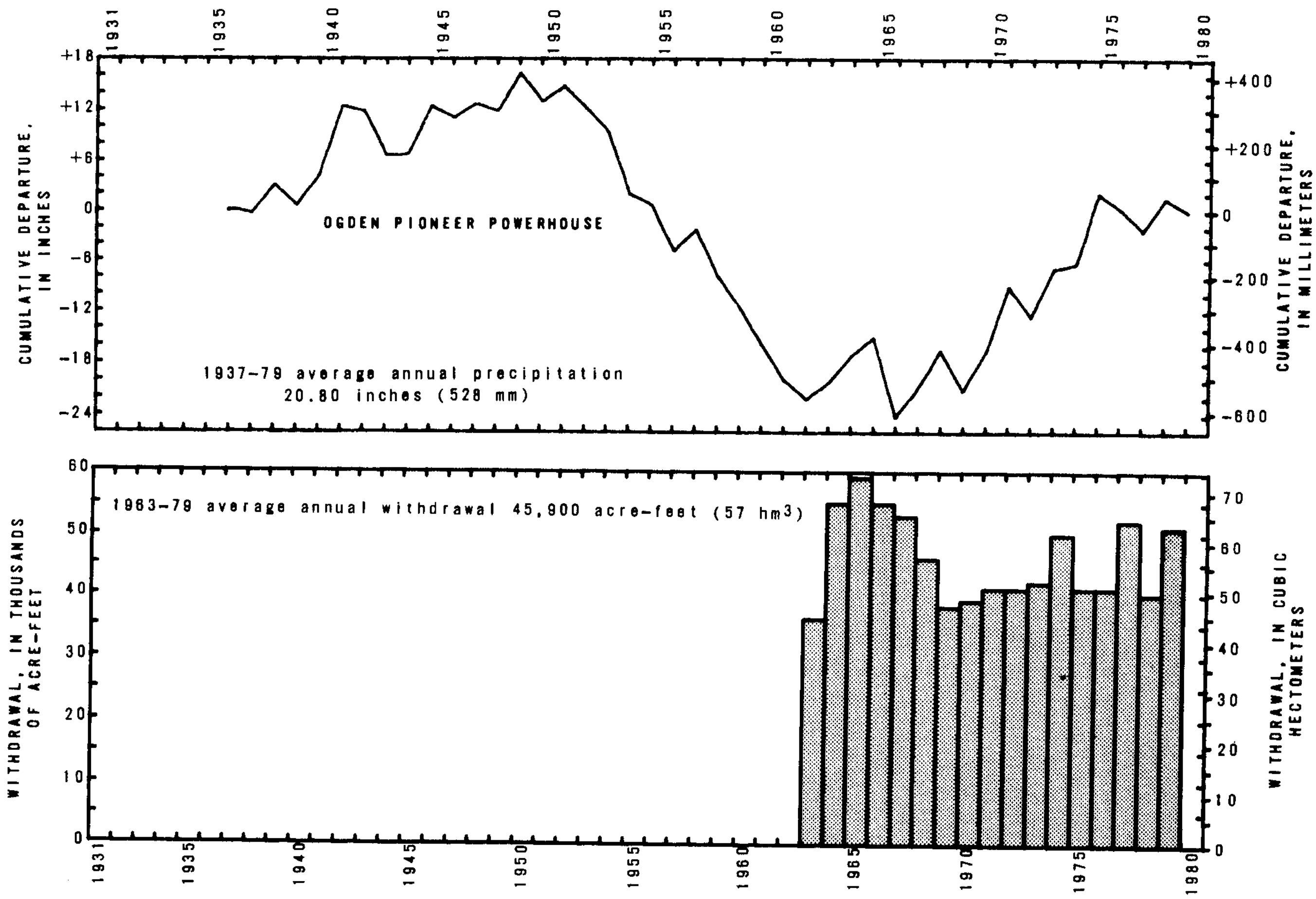



Figure 5.— Continued.

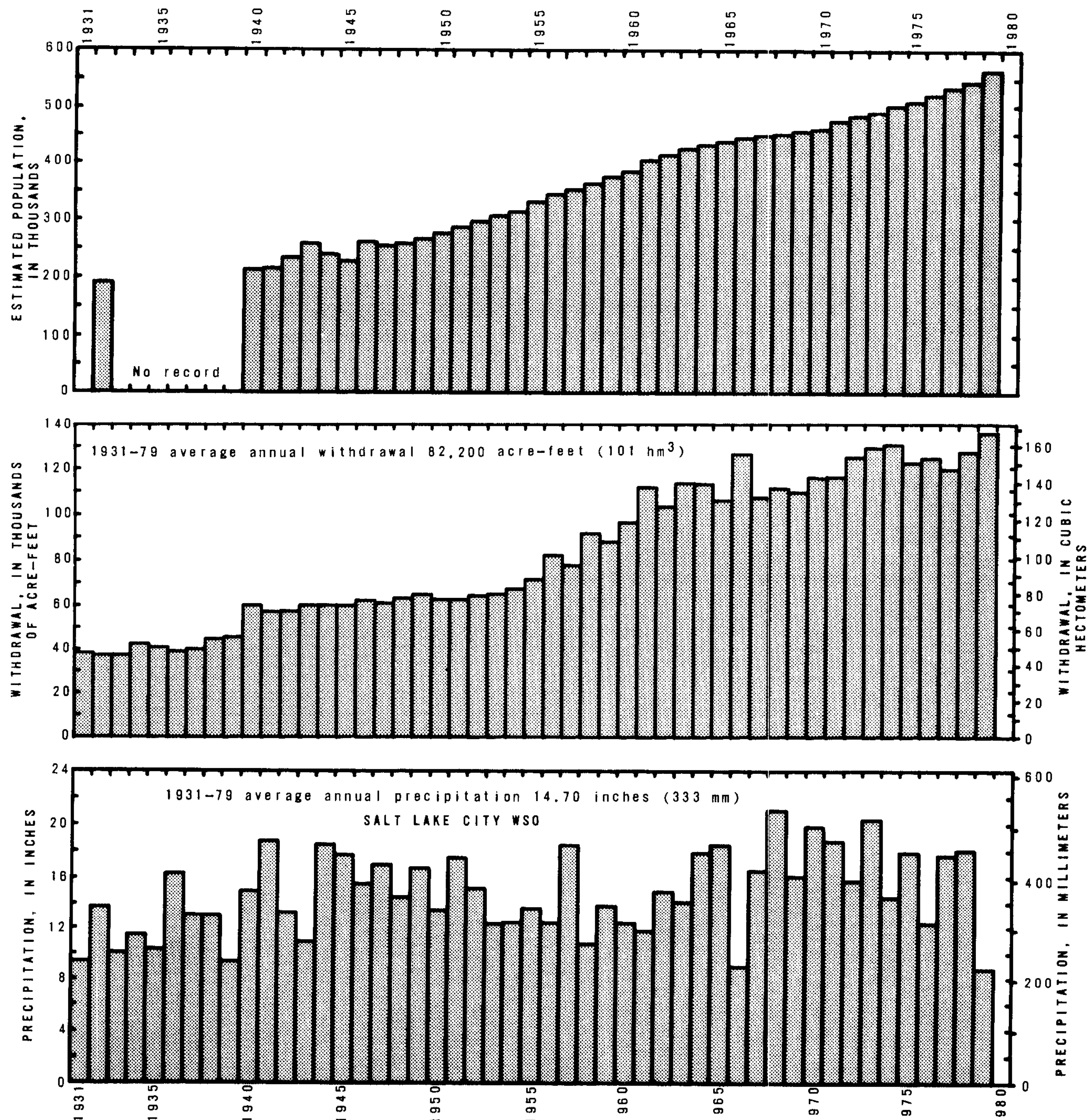



Figure 6.— Estimated population of Salt Lake County, annual withdrawals from wells, and annual precipitation at Salt Lake City WSO (International Airport) for the period 1931-79.

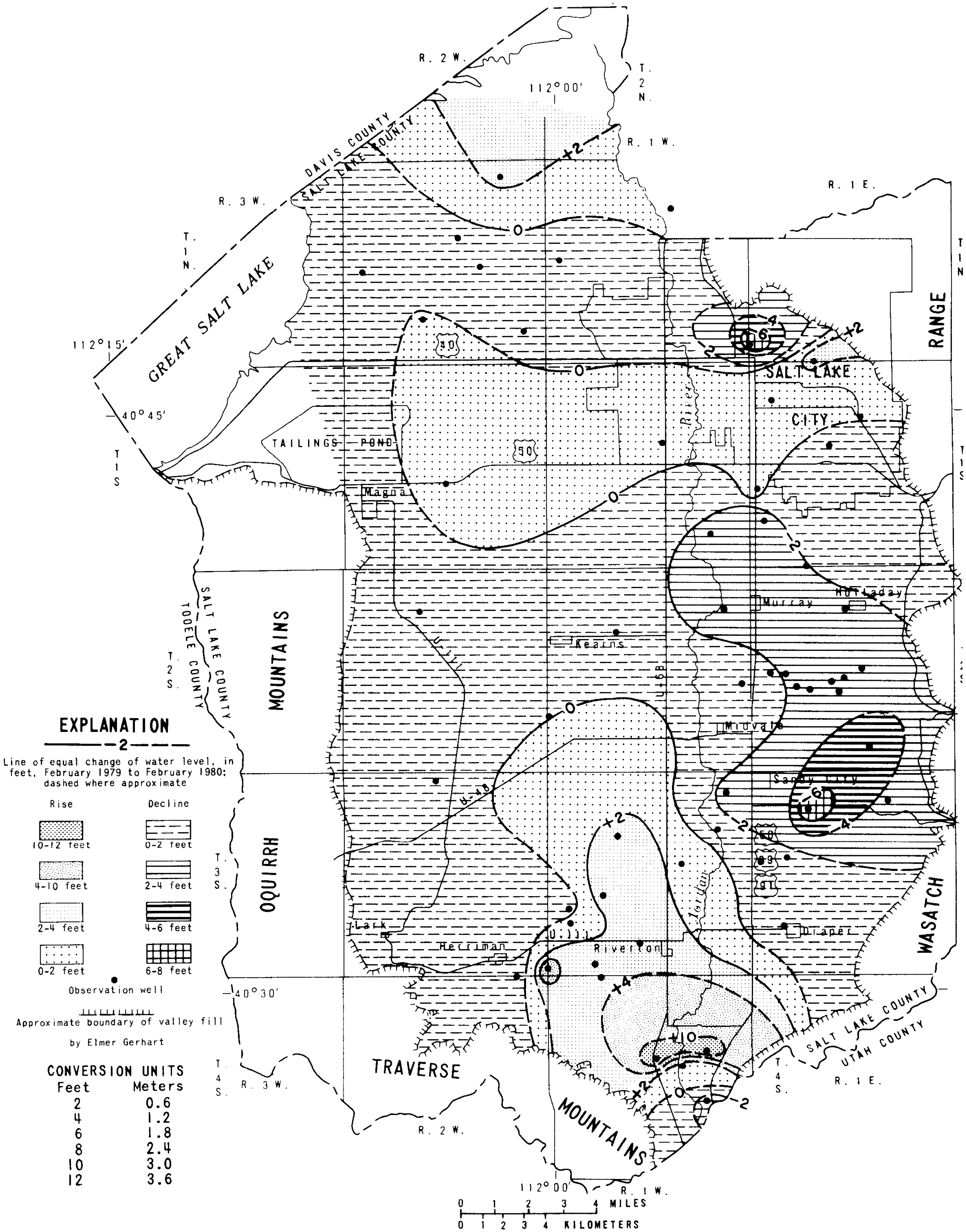



Figure 7.— Map of the Jordan Valley showing change of water levels from February 1979 to February 1980.

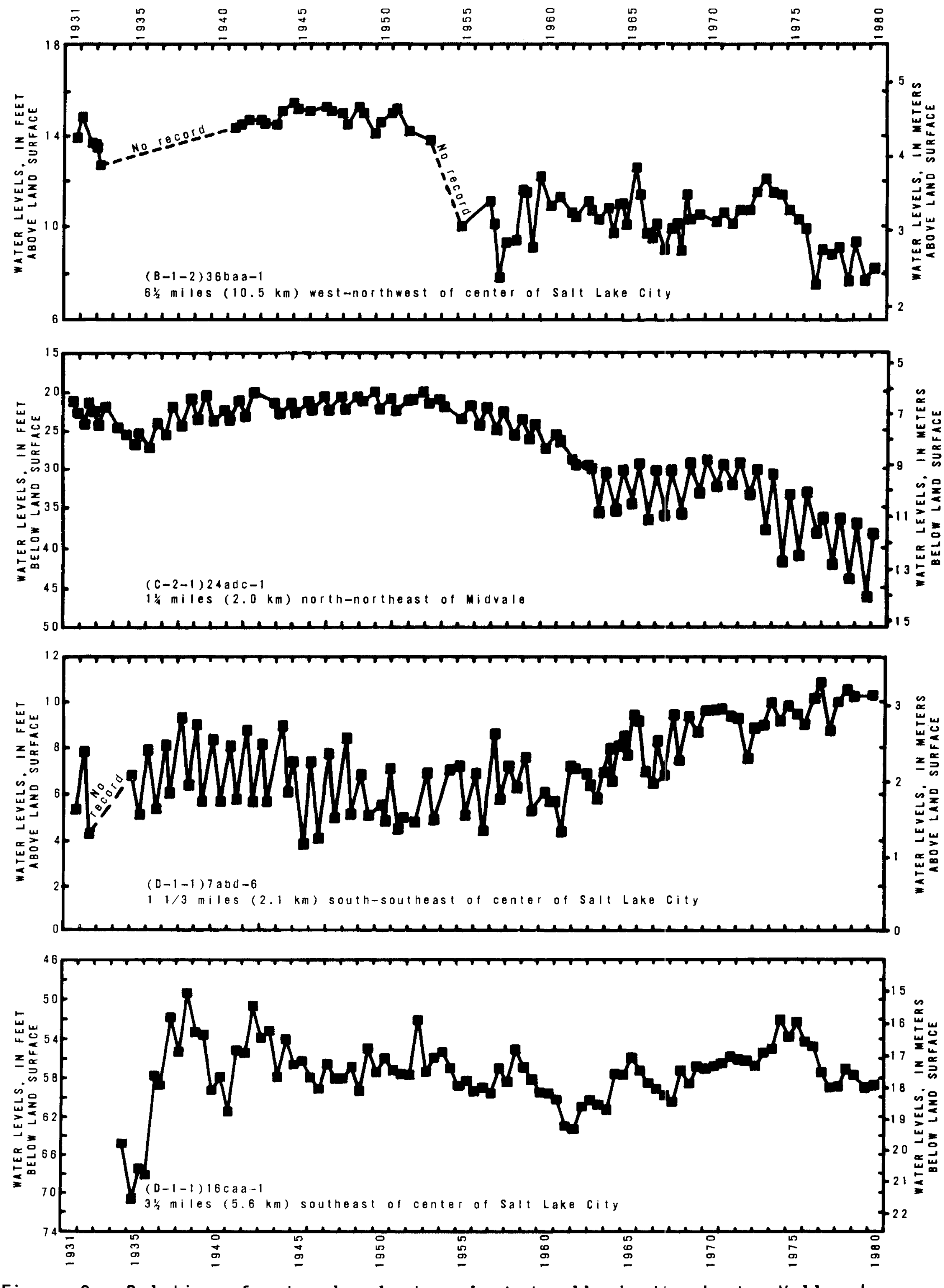



Figure 8.—Relation of water levels in selected wells in the Jordan Valley to cumulative departure from the average annual precipitation at Silver Lake Brighton.

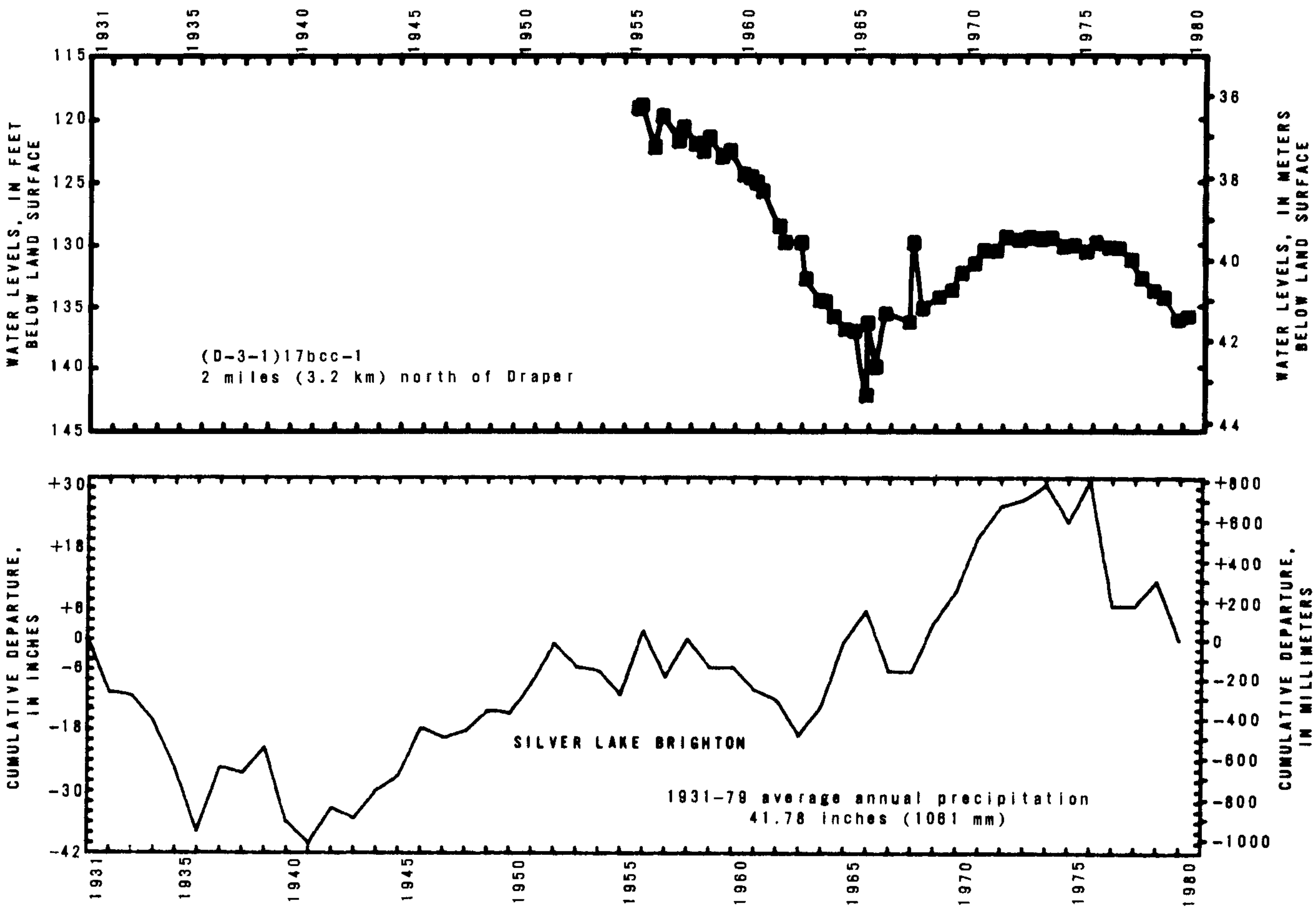



Figure 8.—Continued.

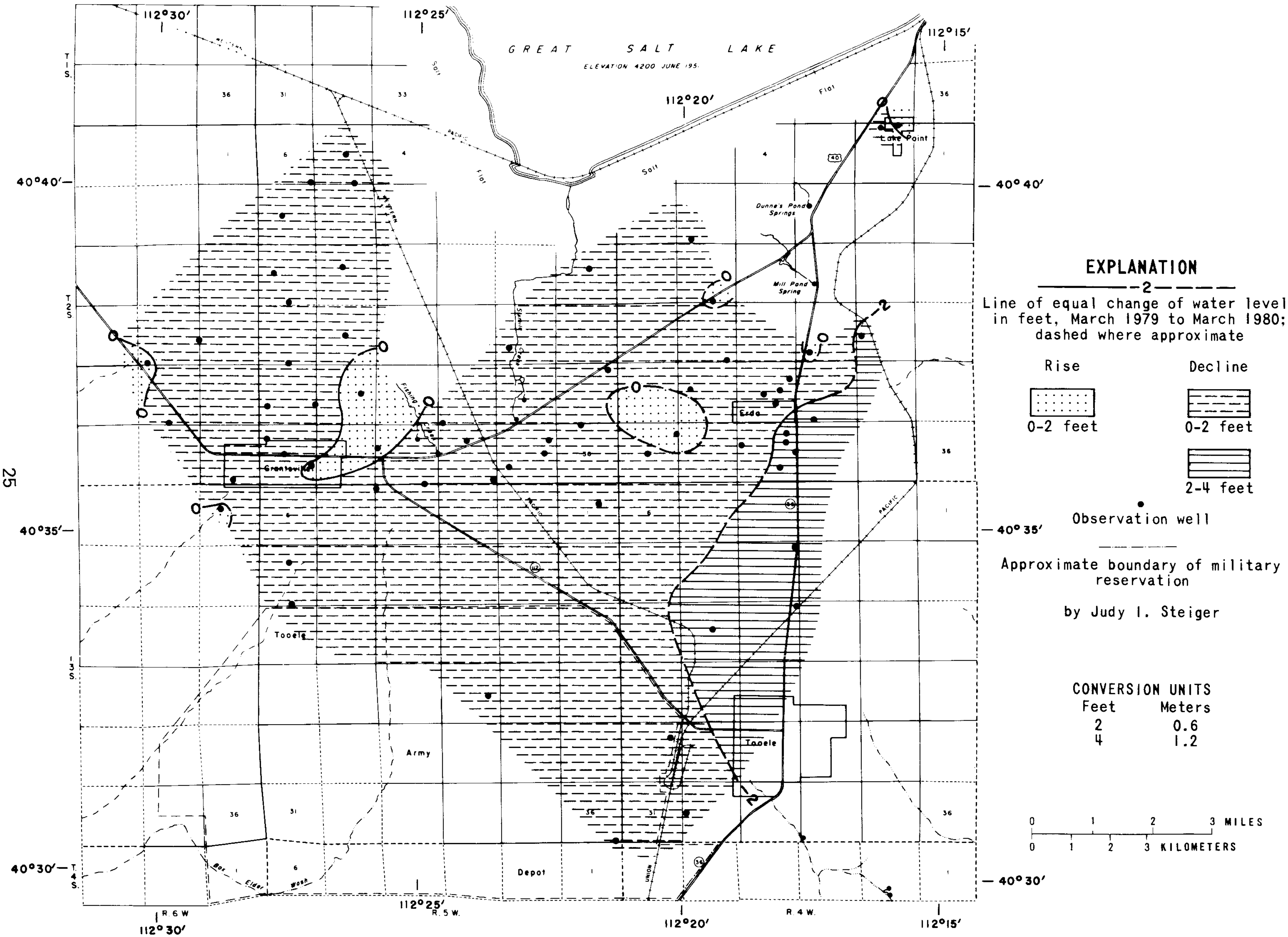



Figure 9.—Map of Tooele Valley showing change of water levels in artesian aquifers from March 1979 to March 1980.

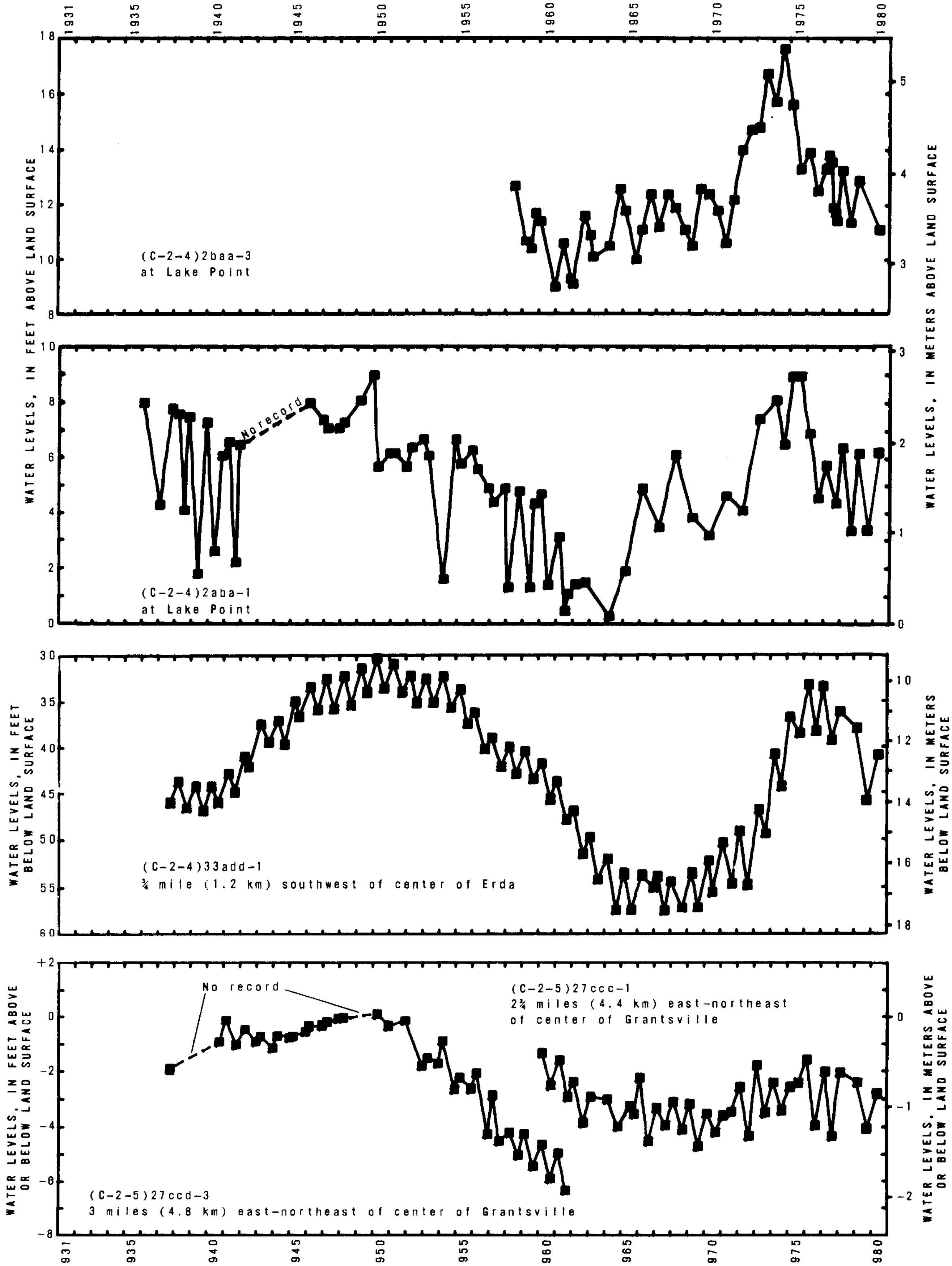



Figure 10.—Relation of water levels in selected wells in Tooele Valley to cumulative departure from the average annual precipitation at Tooele and to annual withdrawals from wells.

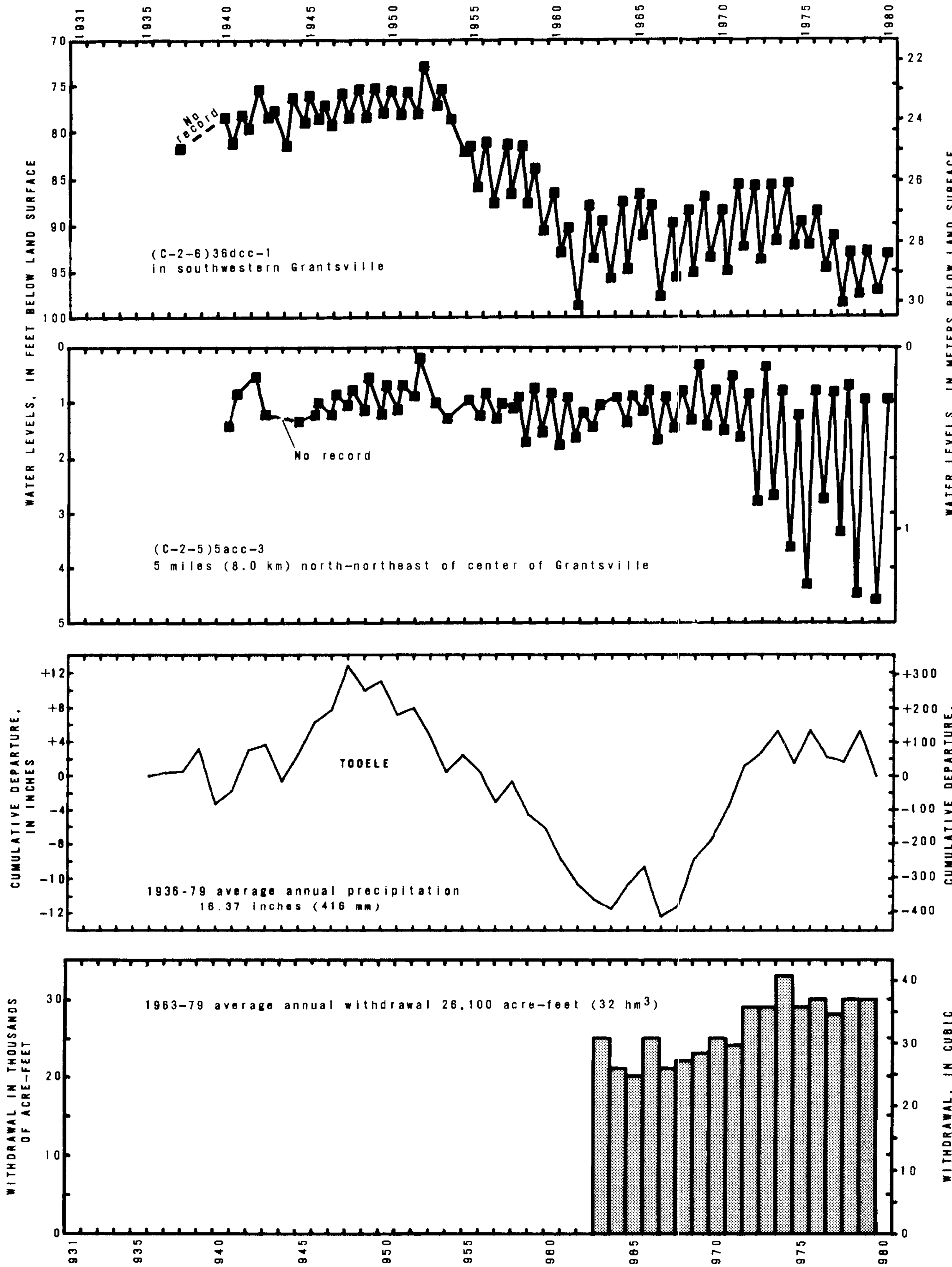



Figure 10.—Continued.

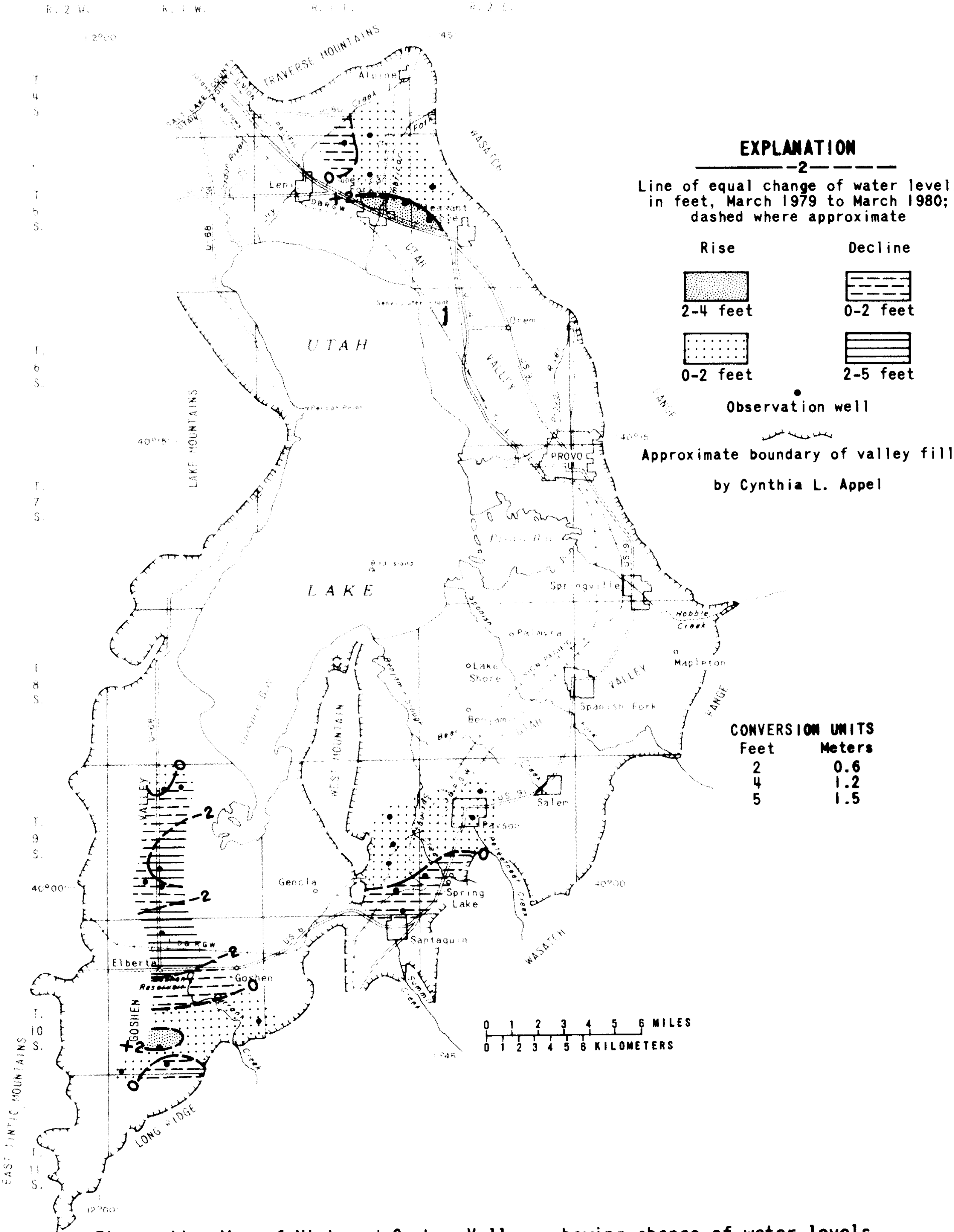



Figure 11.—Map of Utah and Goshen Valleys showing change of water levels in the water-table aquifers from March 1979 to March 1980.

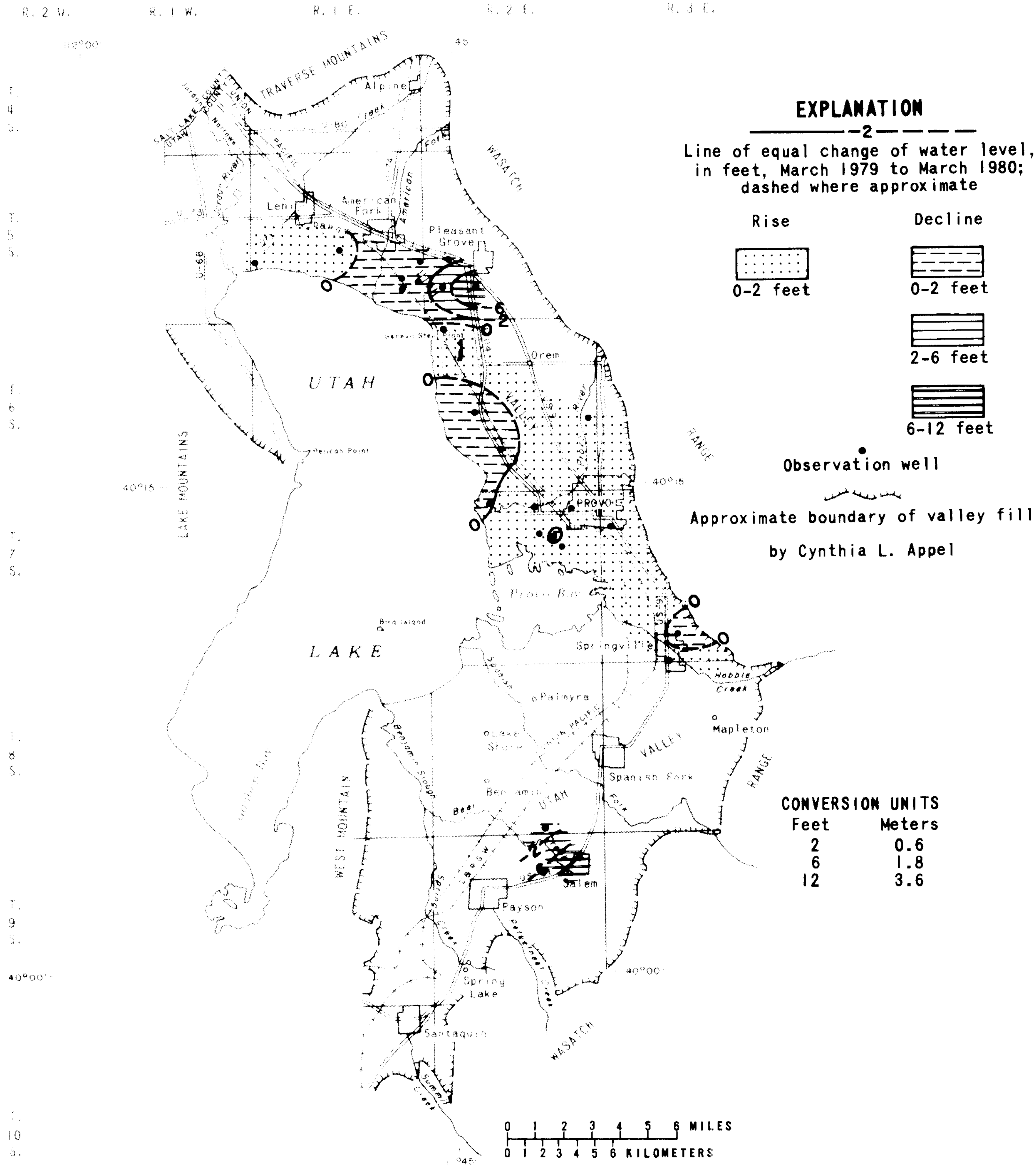



Figure 12.—Map of Utah Valley showing change of water levels in the shallow artesian aquifer in rocks of Pleistocene age from March 1979 to March 1980.

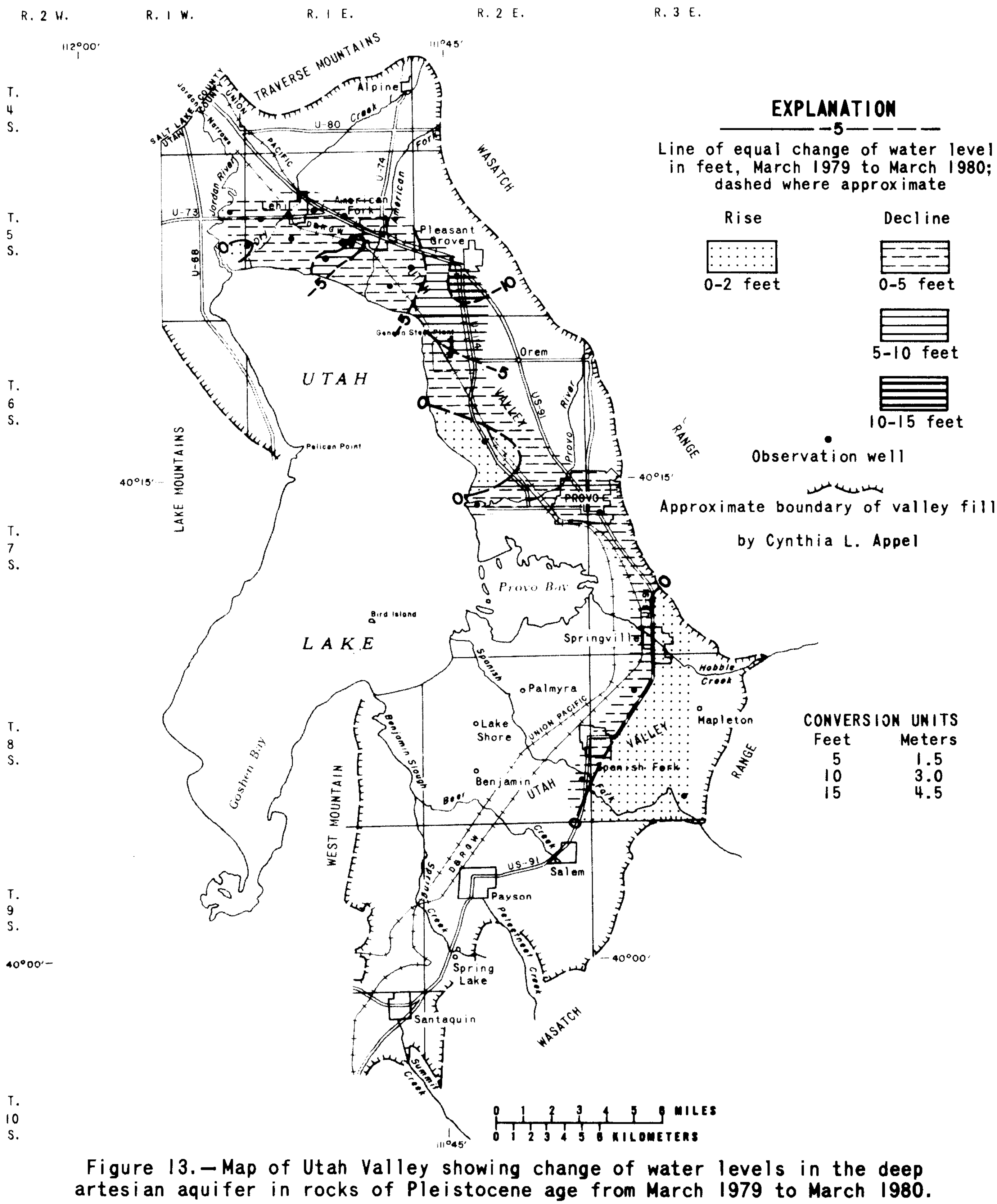



Figure 13.—Map of Utah Valley showing change of water levels in the deep artesian aquifer in rocks of Pleistocene age from March 1979 to March 1980.

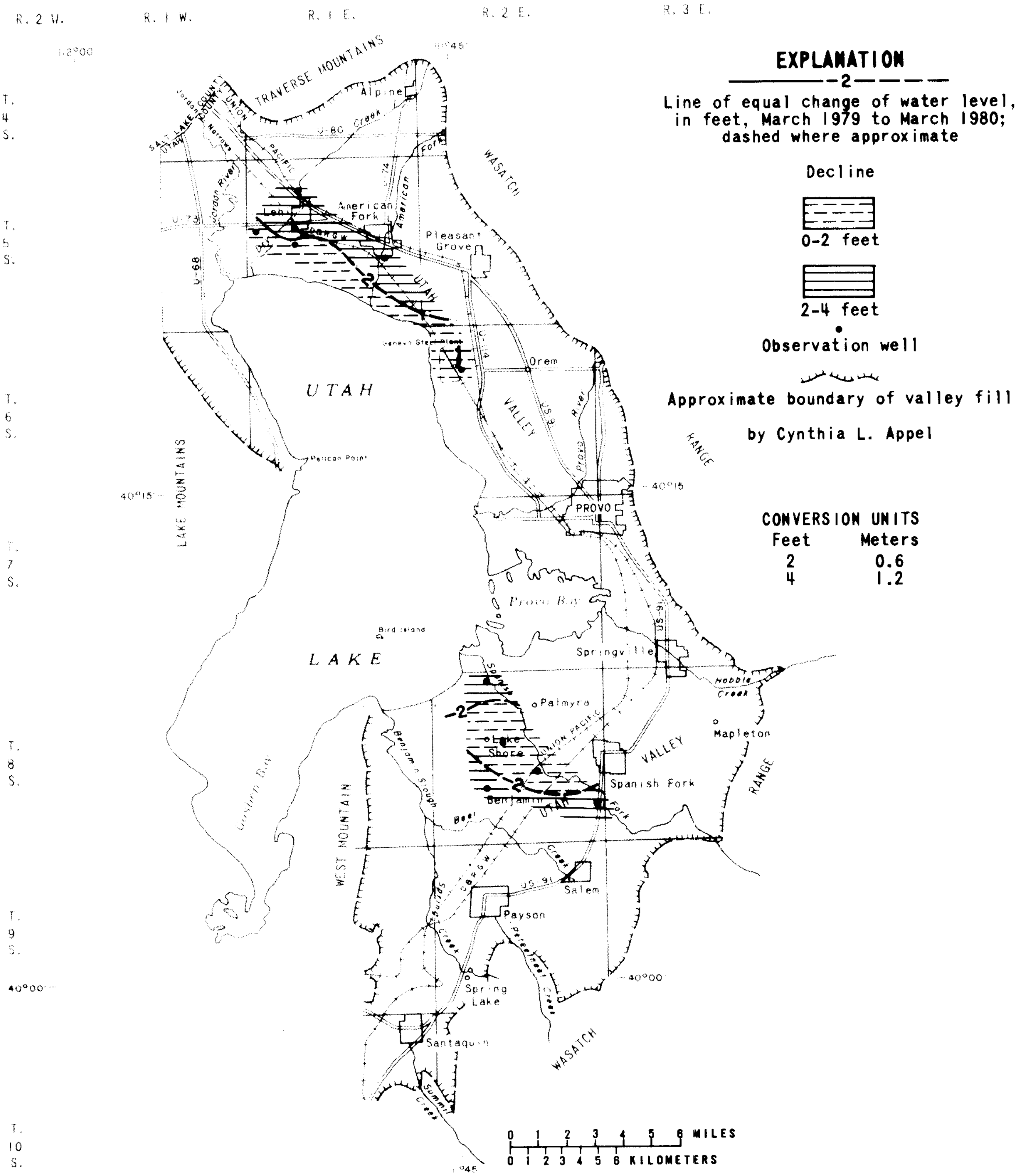



Figure 14.—Map of Utah Valley showing change of water levels in the artesian aquifer in rocks of Tertiary age from March 1979 to March 1980.

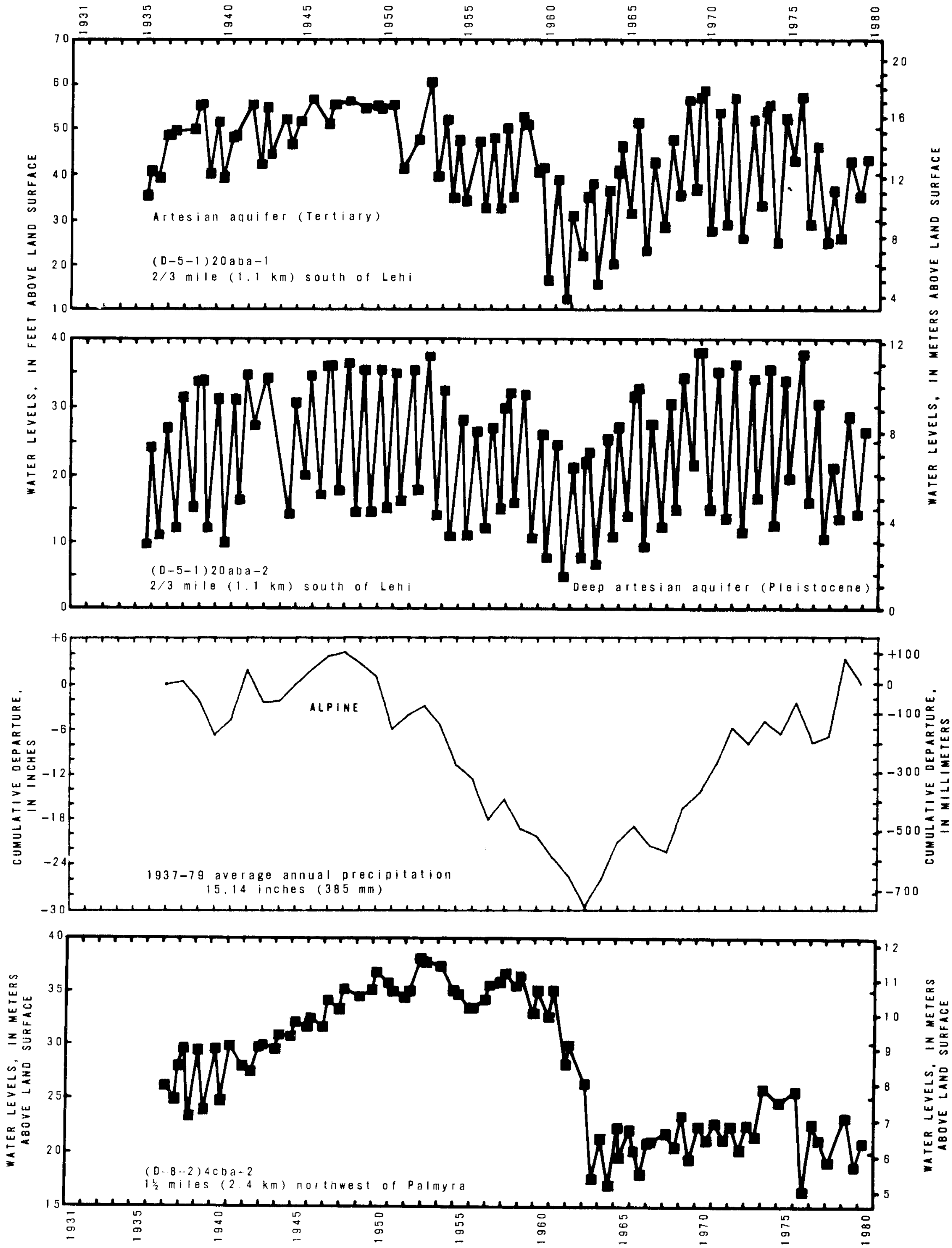



Figure 15.—Relation of water levels in selected wells to cumulative departure from the average annual precipitation at Alpine and Spanish Fork powerhouse and withdrawals from wells in Utah and Goshen Valleys.

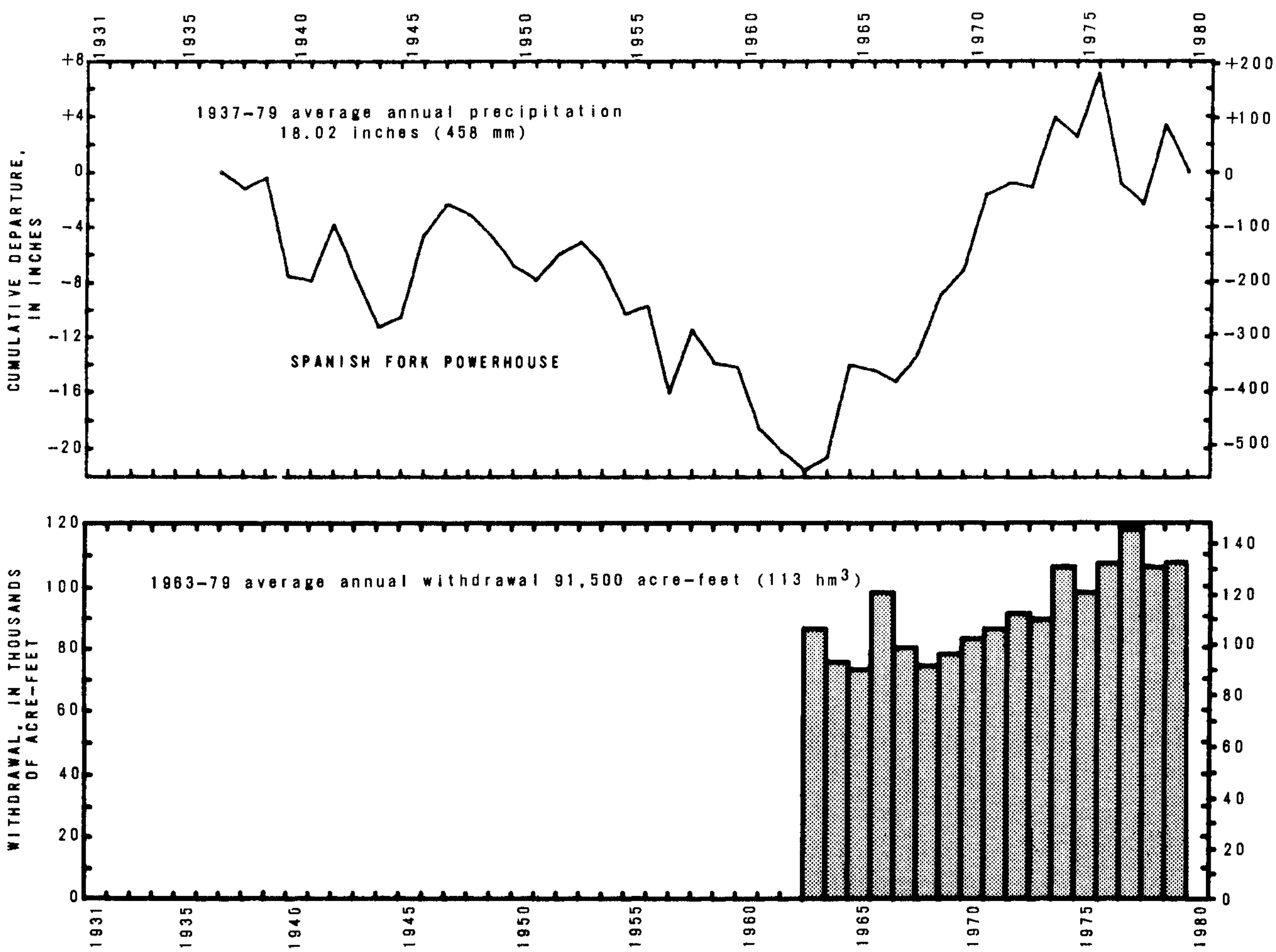
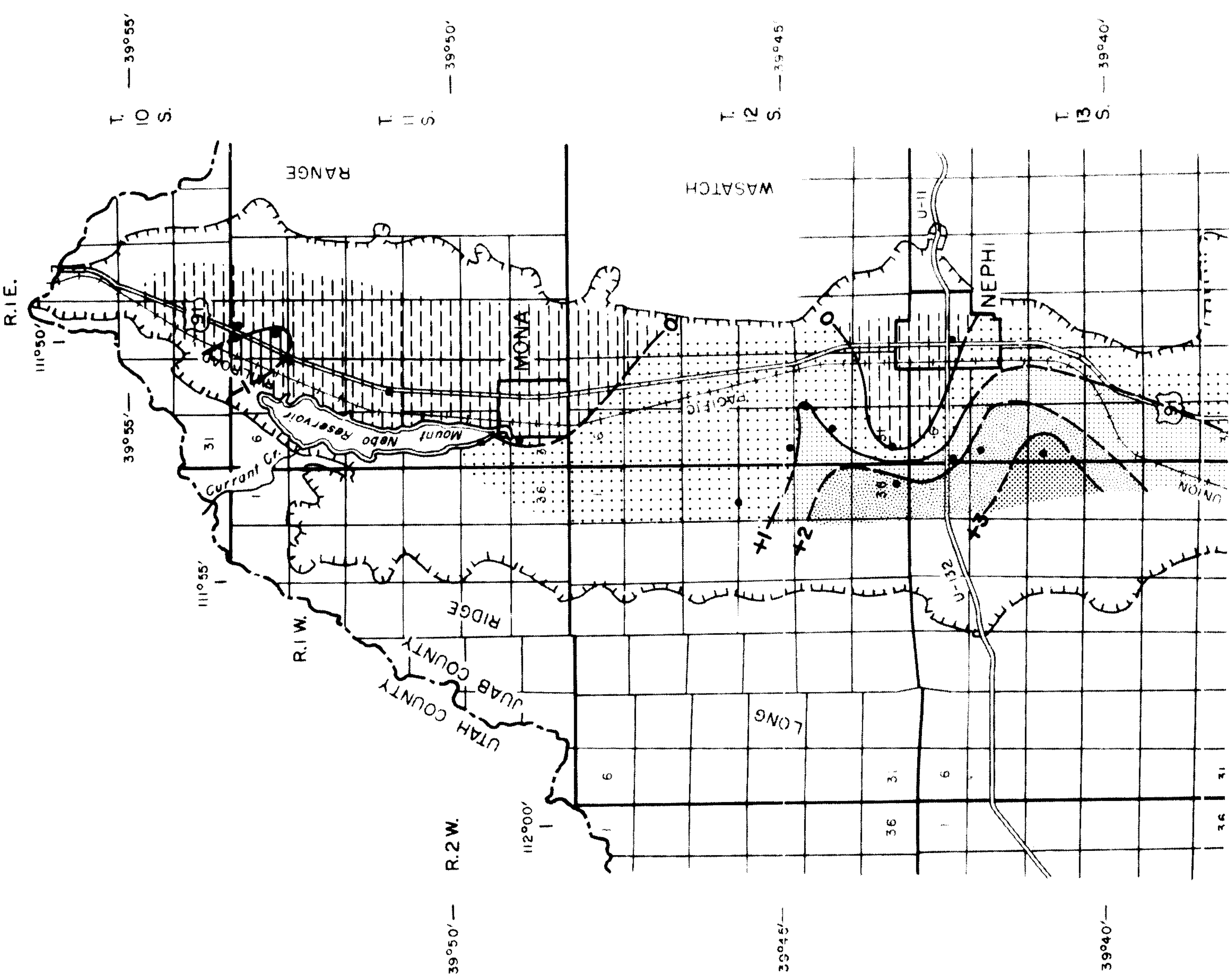



Figure 15.— Continued.



MONA
NEPHI
WASATCH
RANGE
LONG
RIDGE
JUAB COUNTY
UTAH COUNTY
Mount Nebo Reservoir
Currant Cr.
PACIFIC
UNION
R.1 E.
R.1 W.
R.2 W.
T. 10 S.
T. 11 S.
T. 12 S.
T. 13 S.
39°55′
39°50′
39°45′
39°40′
111°50′
111°55′
112°00′
U-11
U-132

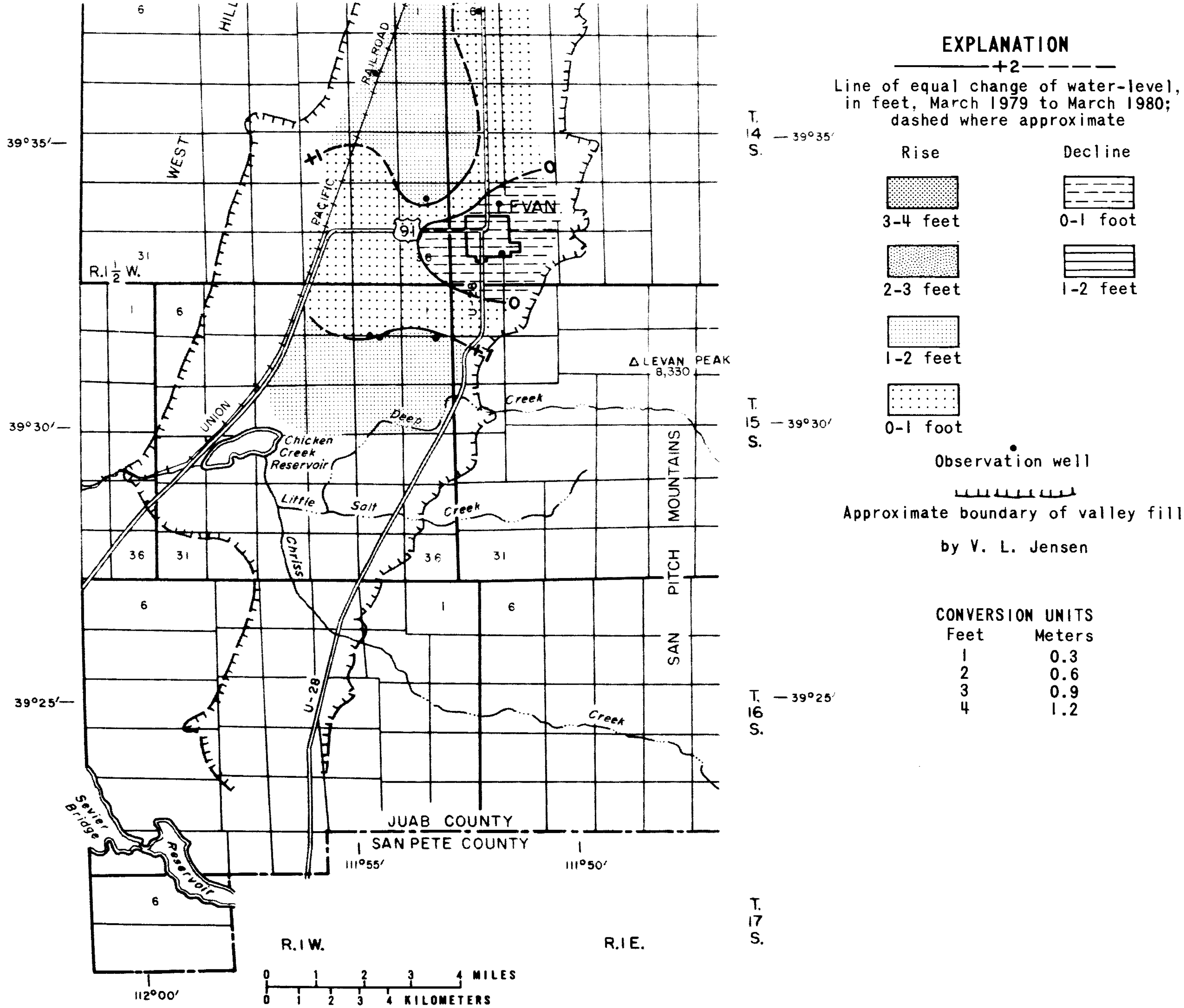



**Figure 16.—Map of Juab Valley showing change of water levels from March 1979 to March 1980.**

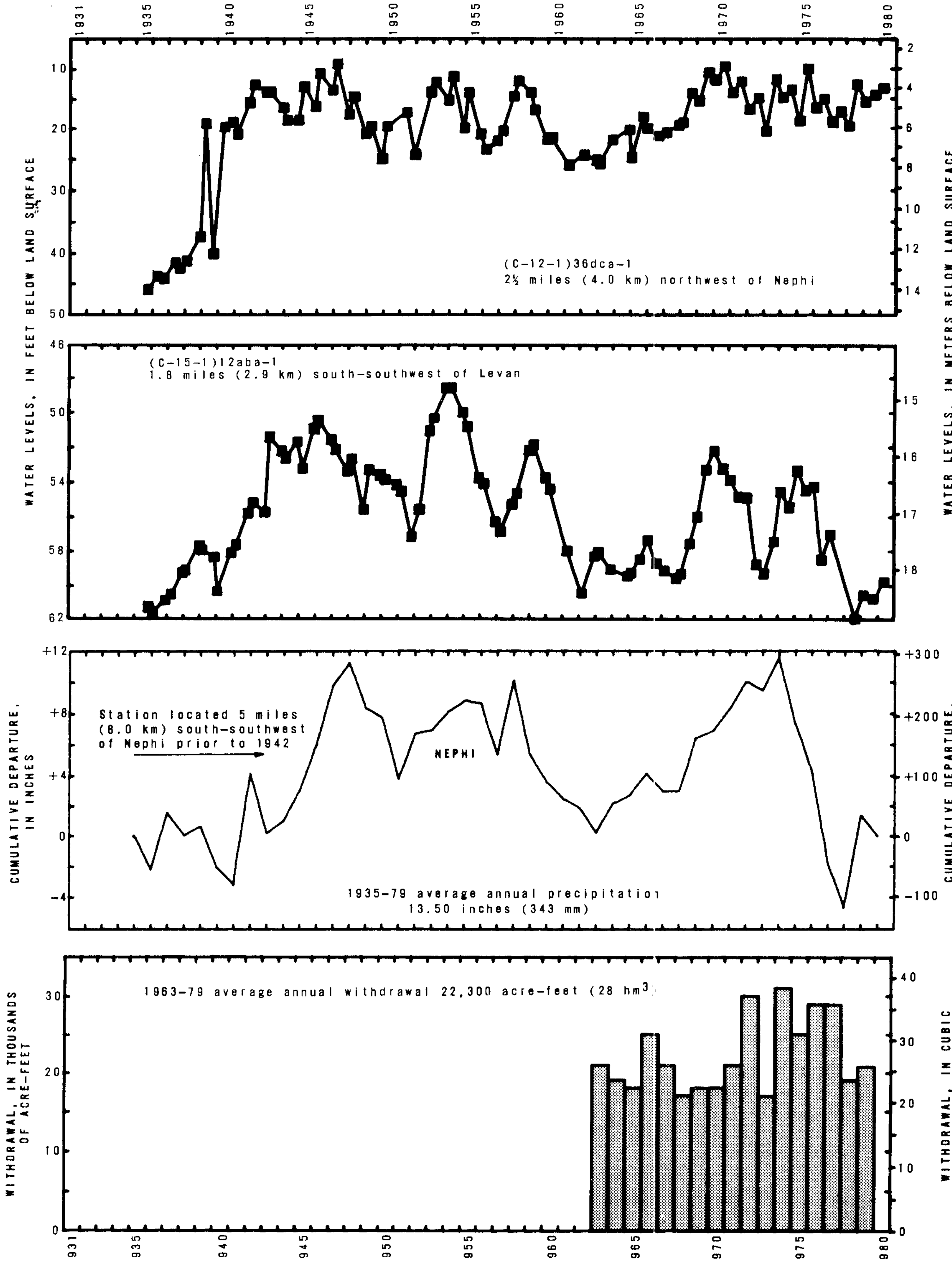



Figure 17.—Relation of water levels in selected wells in Juab Valley to cumulative departure from the average annual precipitation at Nephi and to annual withdrawals from wells.

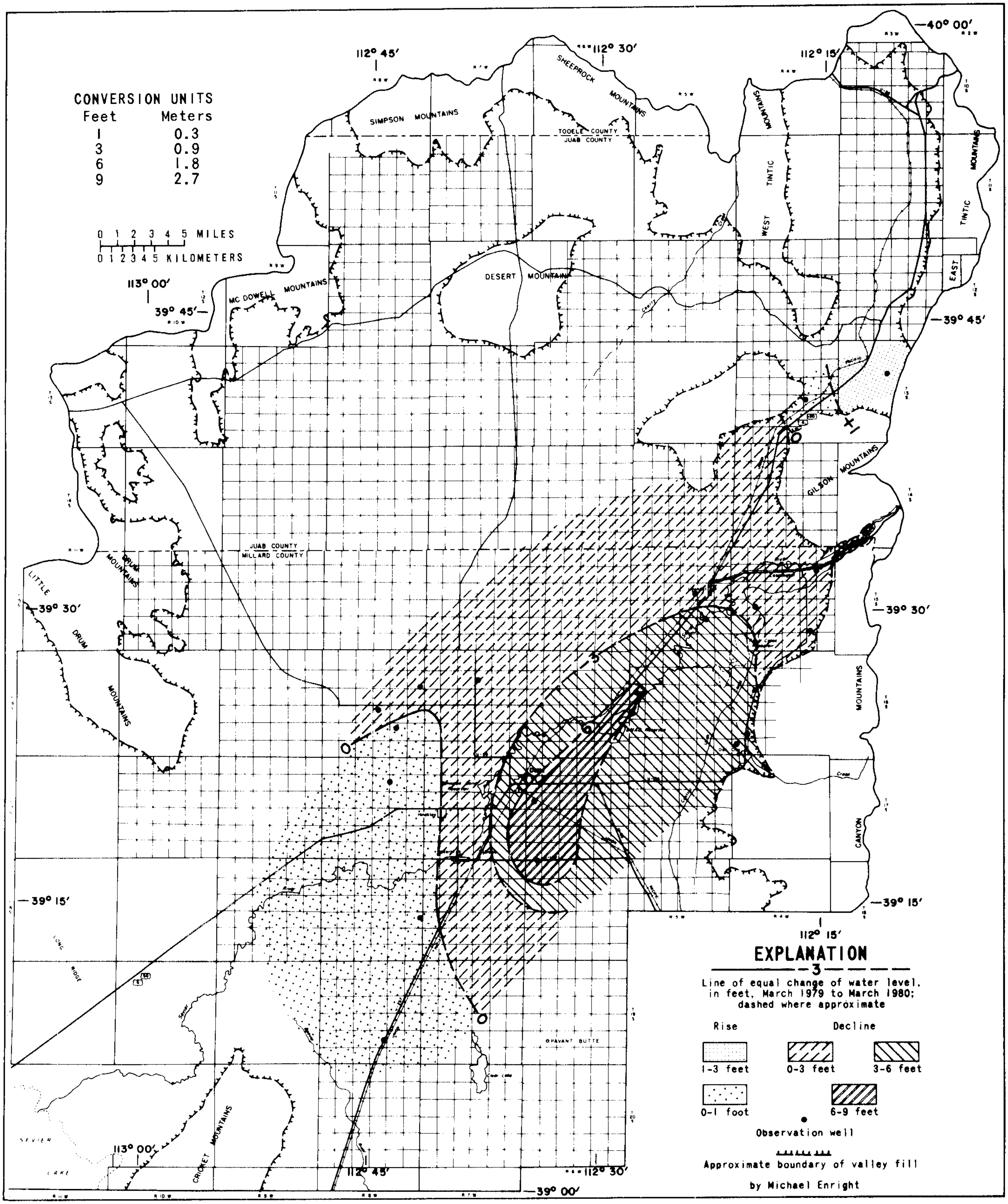



Figure 18.—Map of part of the Sevier Desert showing change of water levels in the lower artesian aquifer from March 1979 to March 1980.

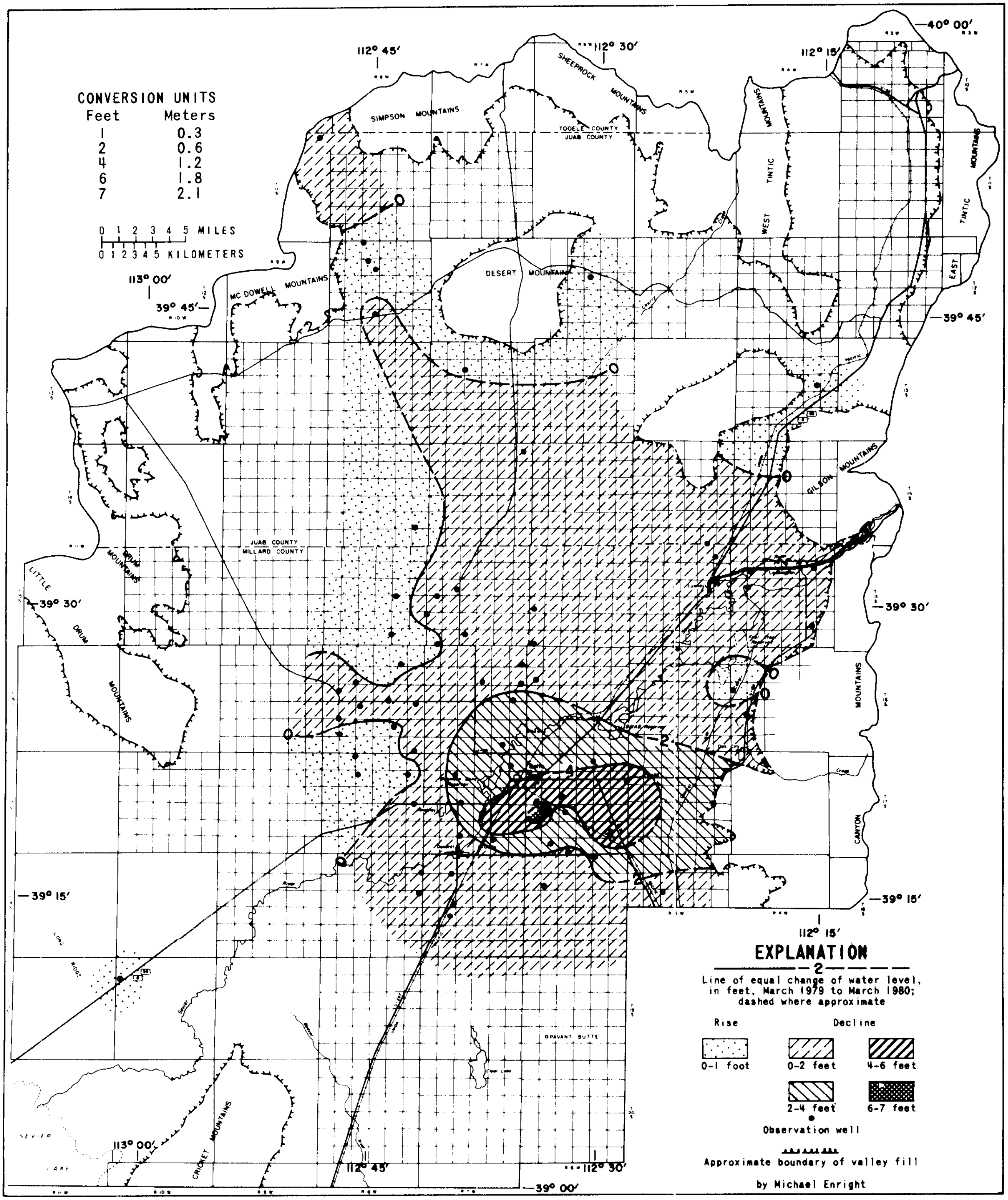



Figure 19.—Map of part of the Sevier Desert showing change of water levels in the upper artesian aquifer from March 1979 to March 1980.

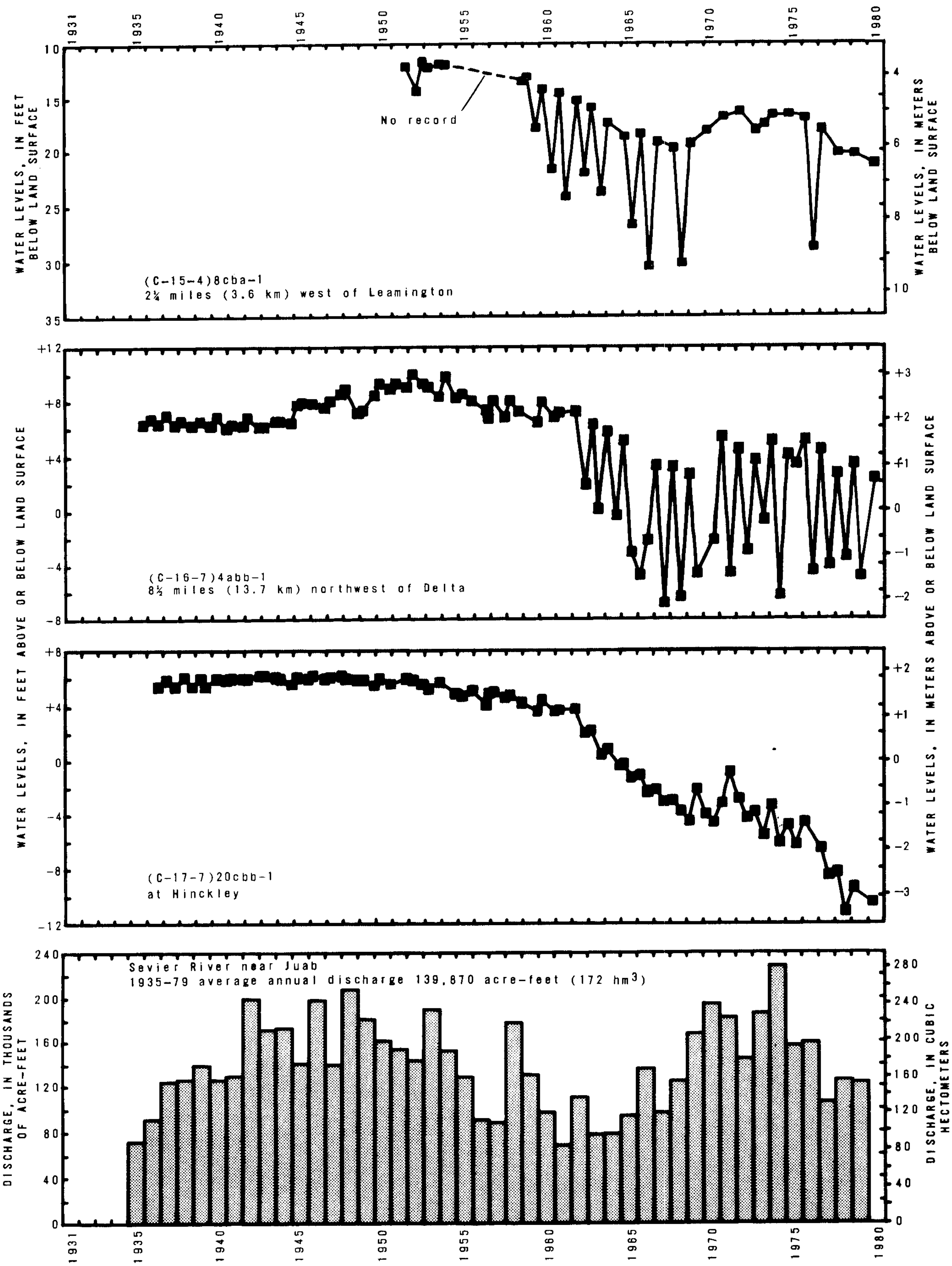



Figure 20.— Relation of water levels in selected wells in the Sevier Desert to discharge of the Sevier River near Juab, to cumulative departure from the average annual precipitation at Oak City, and to annual withdrawals from wells.

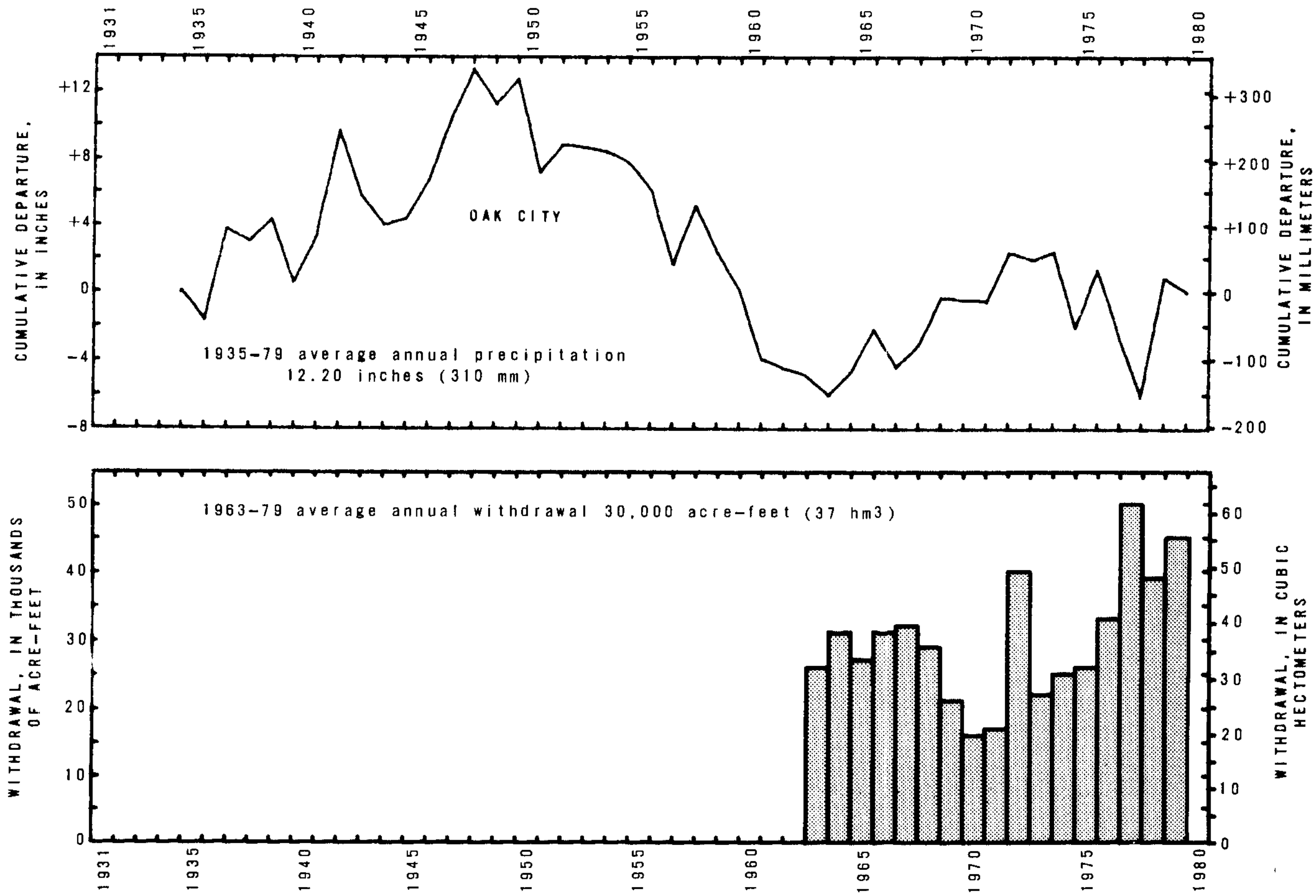



Figure 20.—Continued.

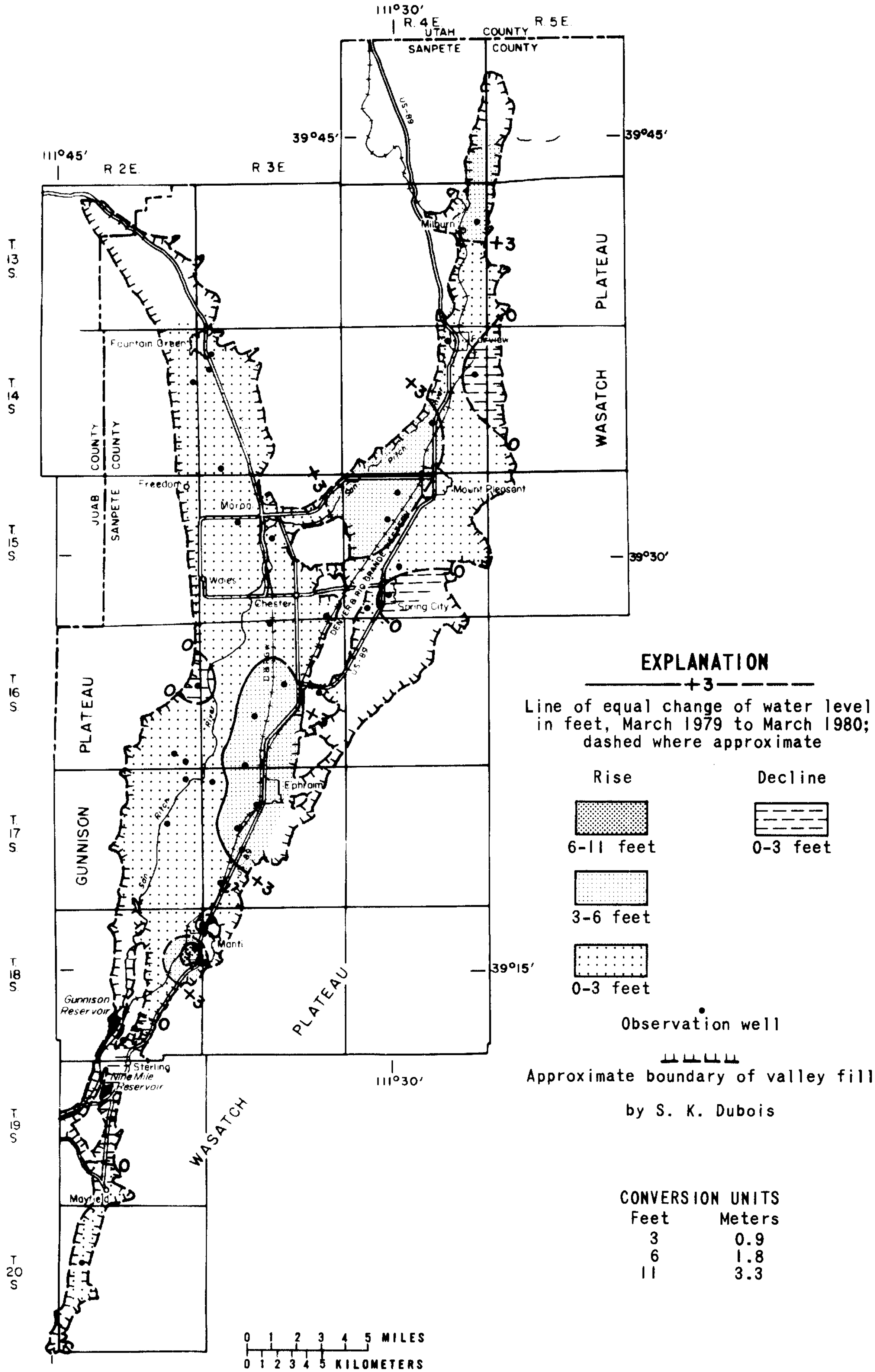



Figure 21.—Map of Sanpete Valley showing change of water levels from March 1979 to March 1980.

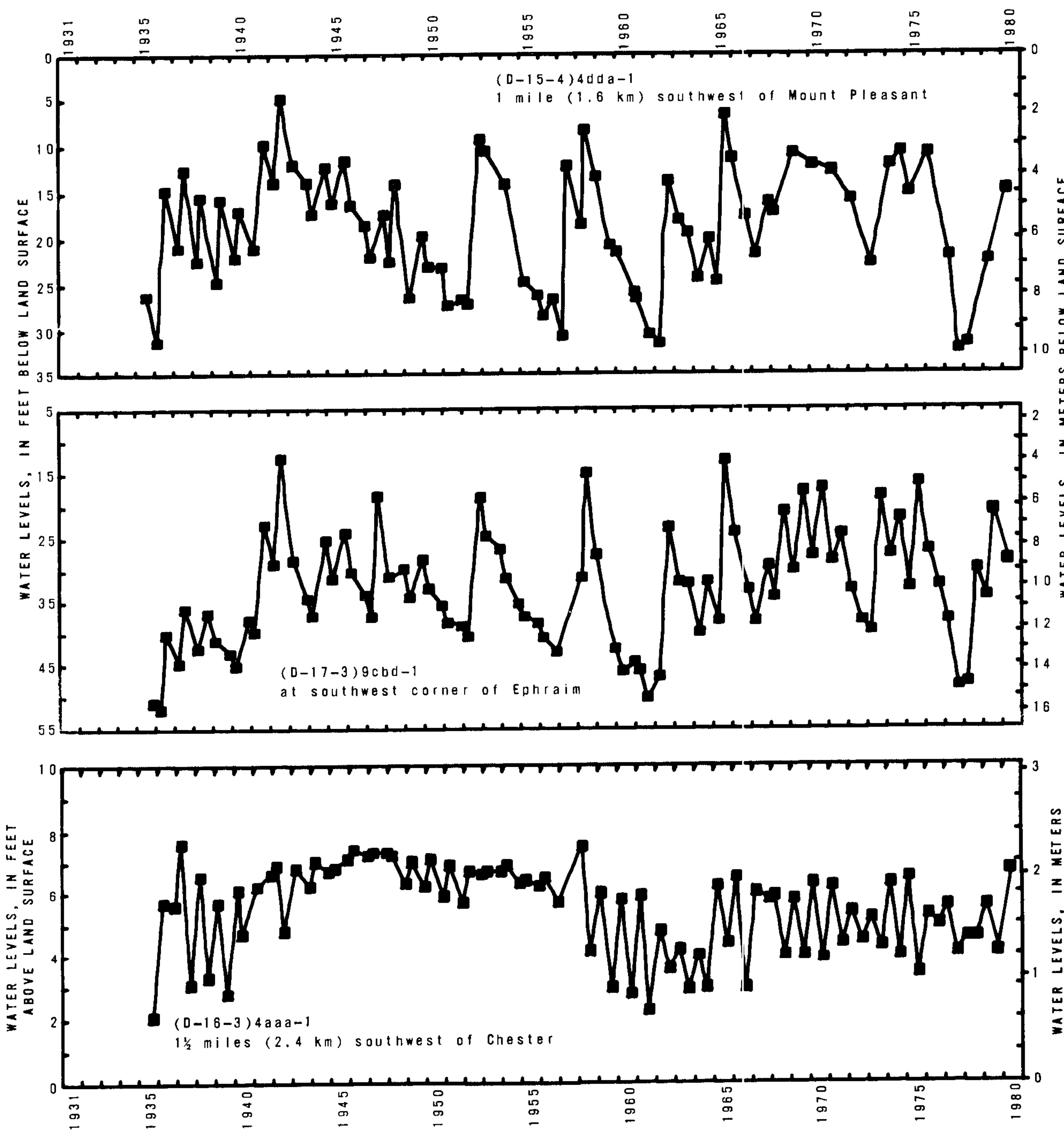



Figure 22.—Relation of water levels in selected wells in Sanpete Valley to cumulative departure from the average annual precipitation at Manti and to annual withdrawals from wells.

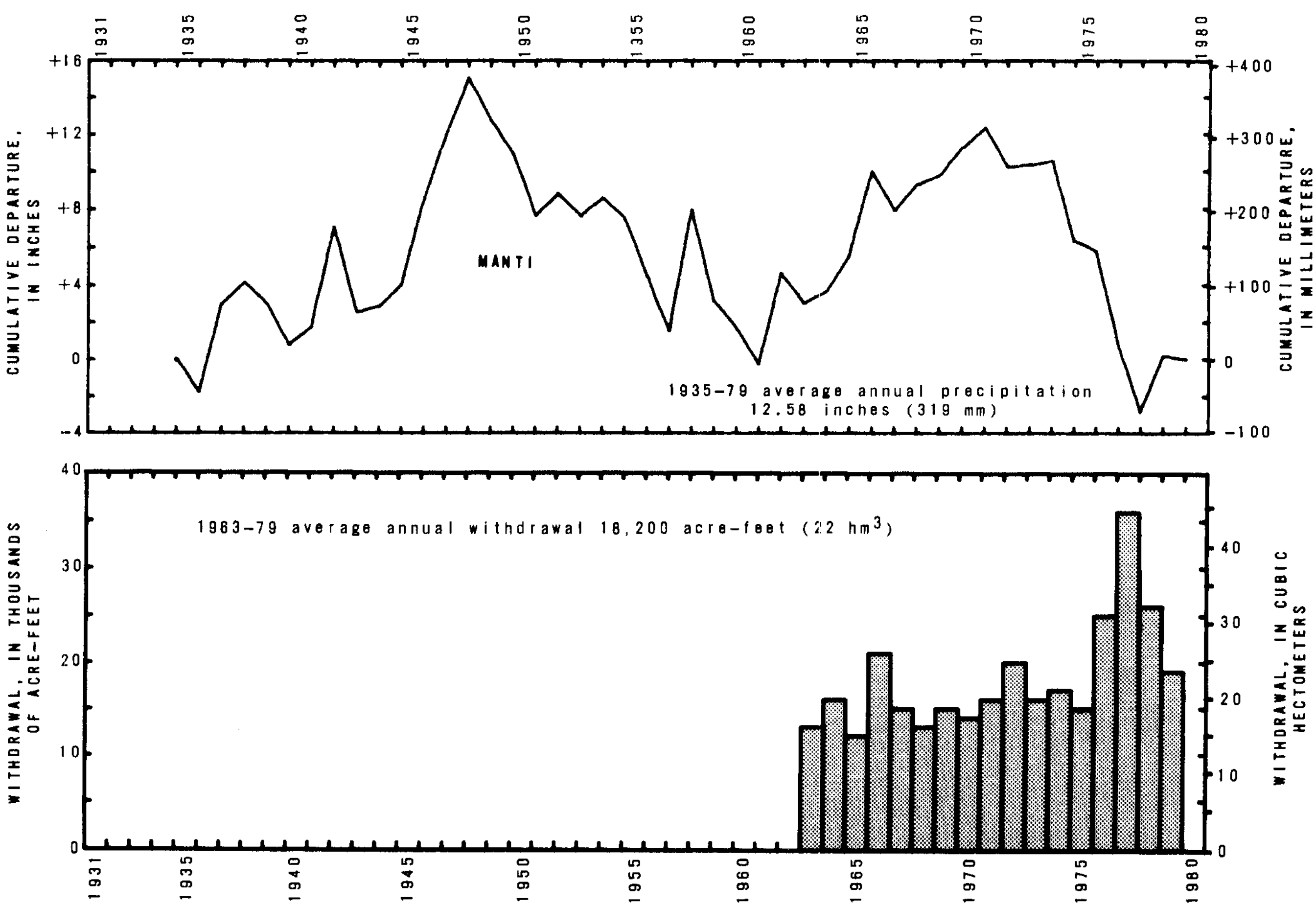
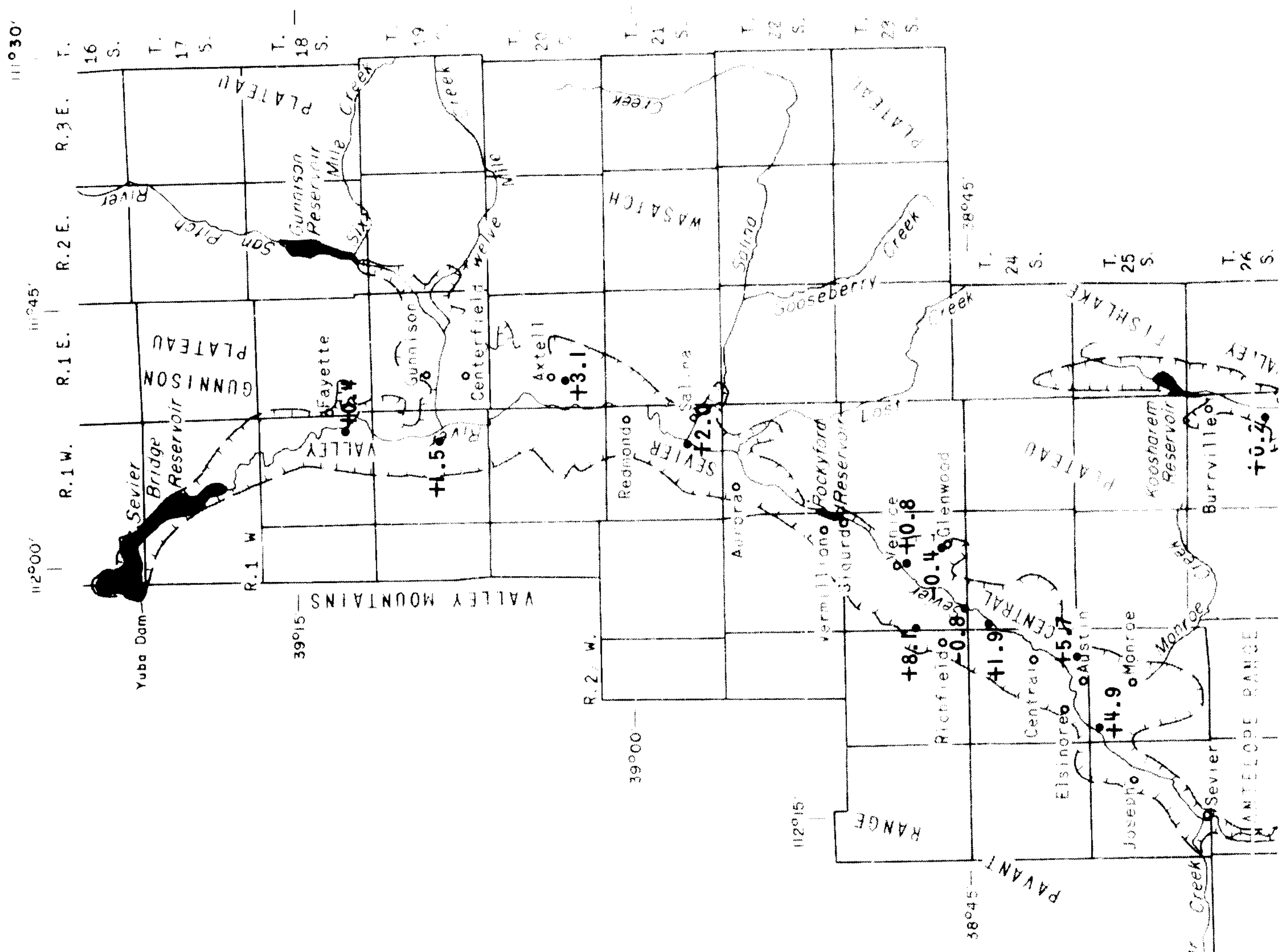



Figure 22.— Continued.



111°30'
111°45'
112°00'
112°15'
39°15'
39°00'
38°45'
R.3 E.
R.2 E.
R.1 E.
R.1 W.
R.2 W.
T. 16 S.
T. 17 S.
T. 18 S.
T. 19 S.
T. 20 S.
T. 21 S.
T. 22 S.
T. 23 S.
T. 24 S.
T. 25 S.
T. 26 S.
Yuba Dam
Sevier Bridge Reservoir
Gunnison Reservoir
San Pitch River
Six Mile Creek
Twelve Mile Creek
GUNNISON PLATEAU
WASATCH PLATEAU
VALLEY MOUNTAINS
SEVIER VALLEY
FISHLAKE PLATEAU
PAVANT RANGE
Fayette
Gunnison
Centerfield
Axtell
Salina
Redmondo
Aurora
Salina Creek
Gooseberry Creek
Lost Creek
Rockyford Reservoir
Sigurd
Vermillion
Venice
Glenwood
Richfield
Central
Austin
Monroe
Monroe Creek
Elsinore
Joseph
Sevier
Clear Creek
Koosharem Reservoir
Burrville
+1.5
+3.1
+2.0
+0.8
-0.4
-0.8
+1.9
+5.7
+4.9

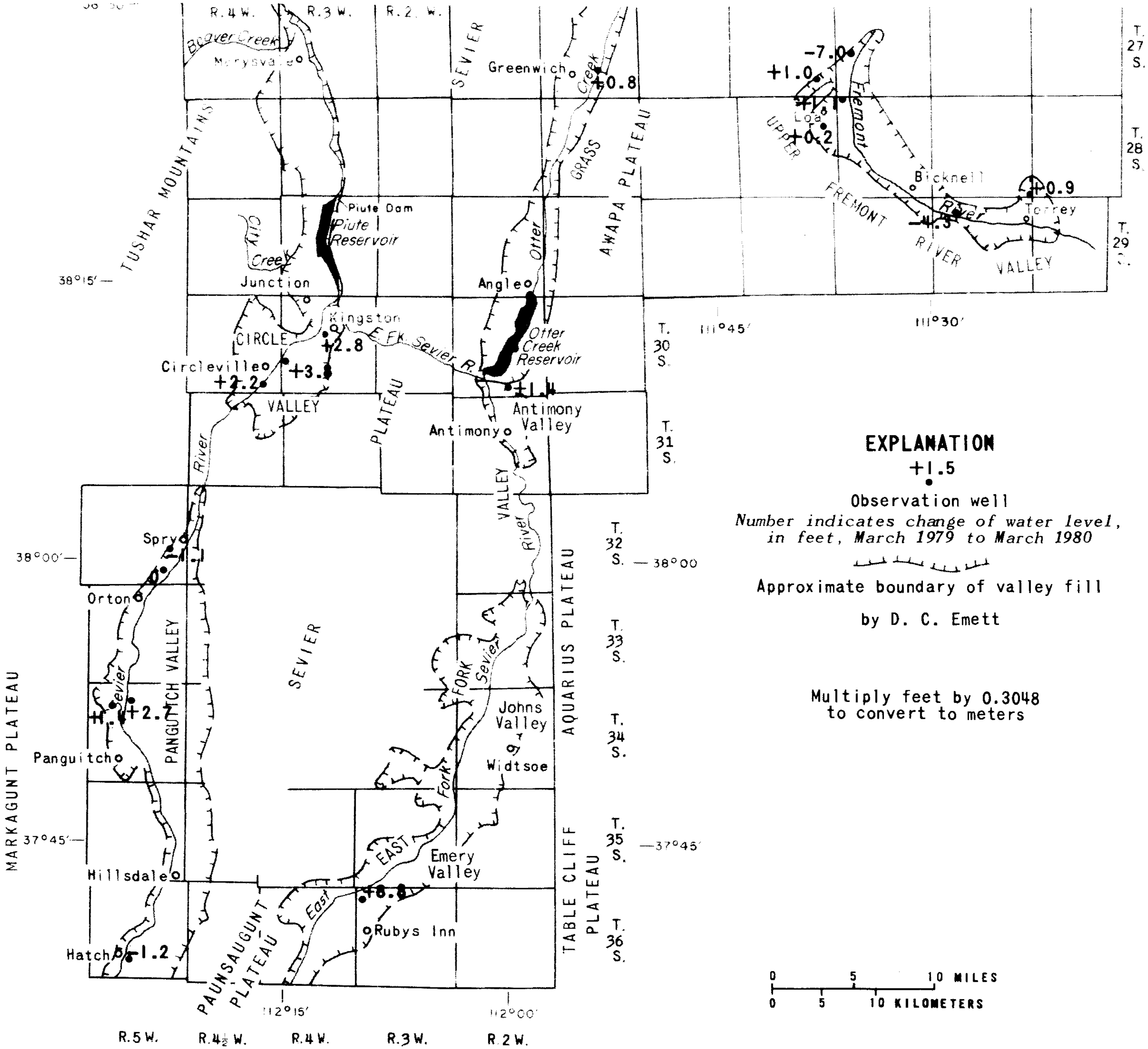



Figure 23.—Map of the upper and central Sevier Valleys and upper Fremont River valley showing change of water levels from March 1979 to March 1980.

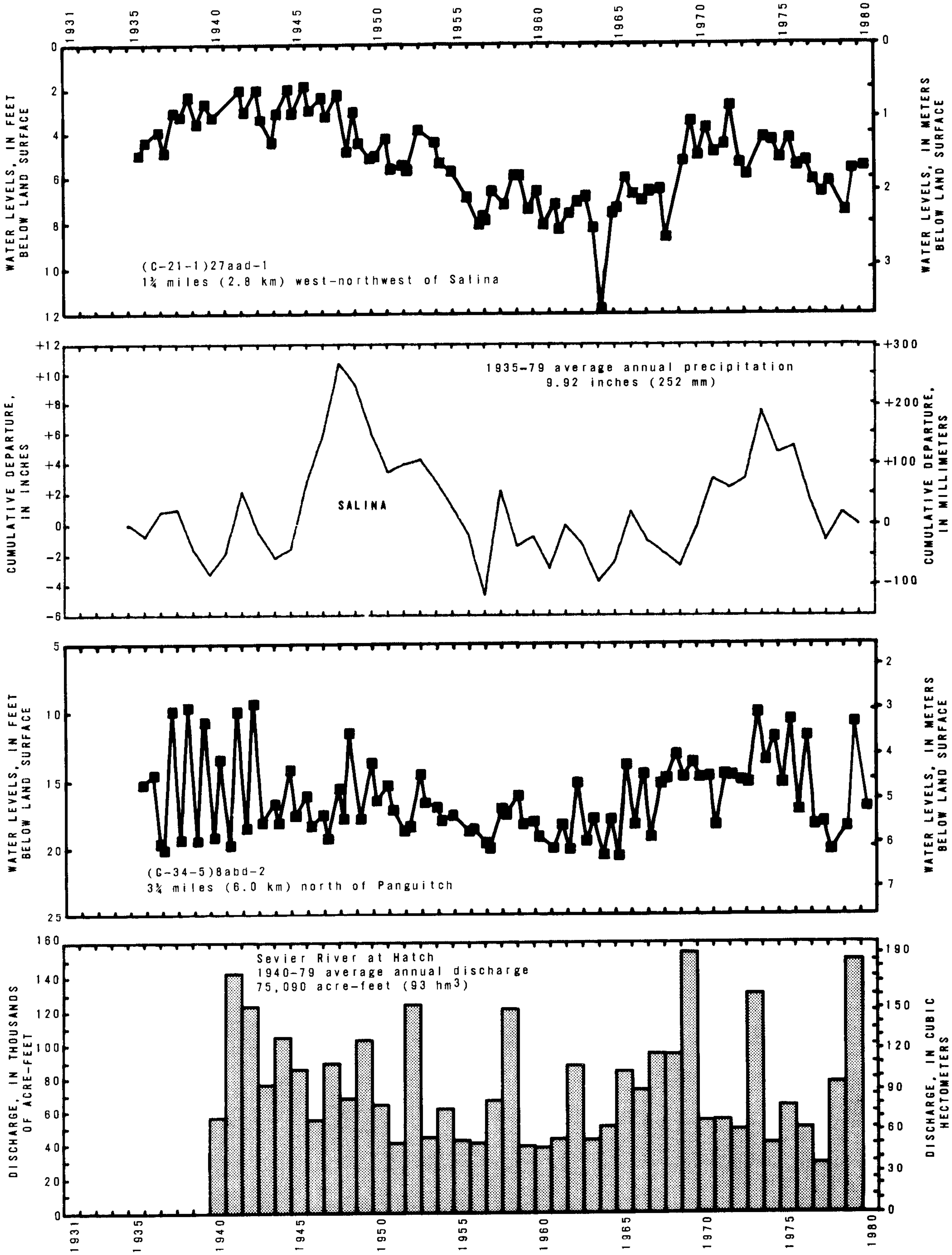



Figure 24.—Relation of water levels in selected wells to discharge of the Sevier River at Hatch, to cumulative departure from average annual precipitation at selected climate stations, and to annual withdrawals from wells—upper and central Sevier Valleys and upper Fremont River valley.

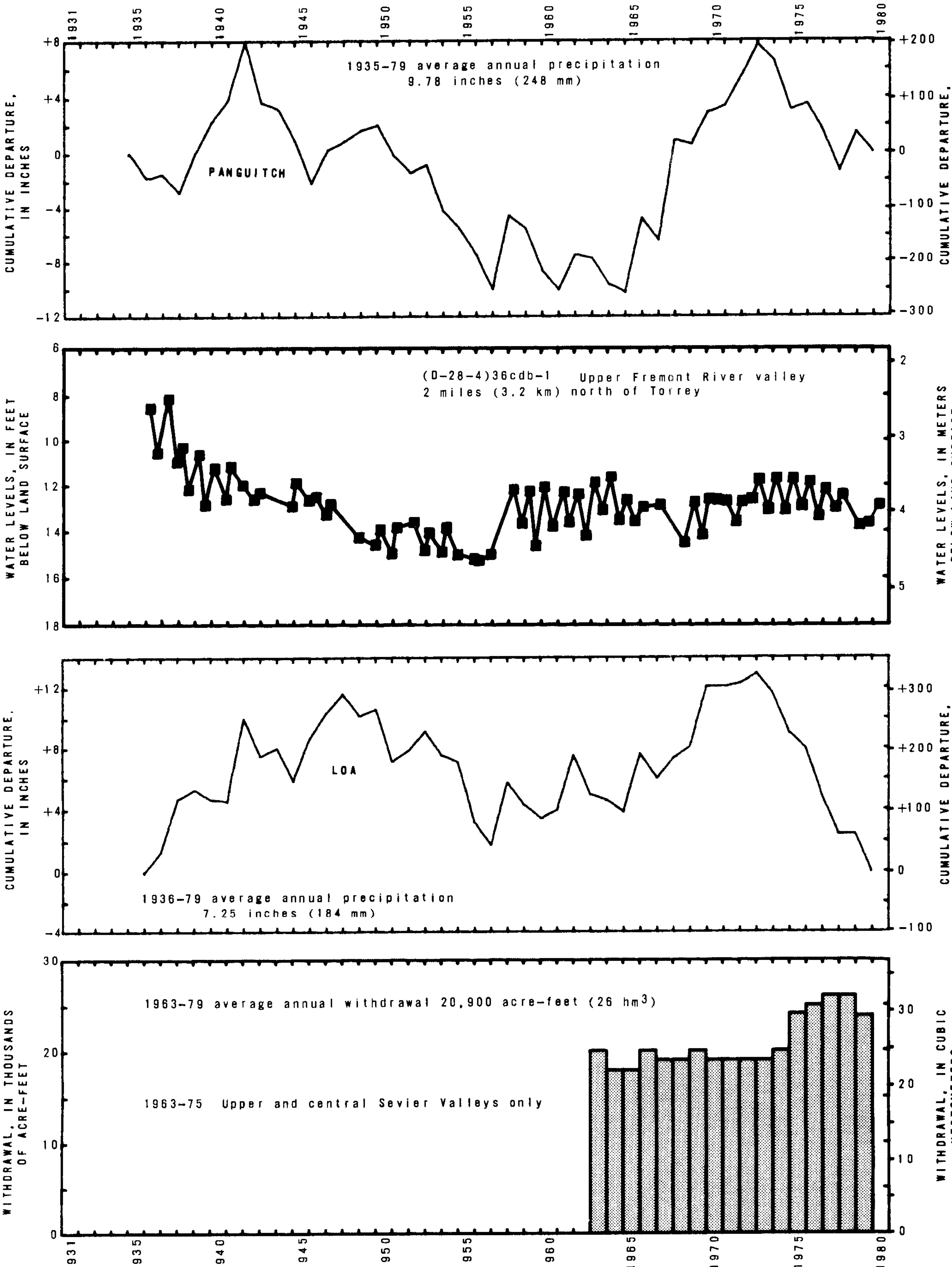



Figure 24.— Continued.

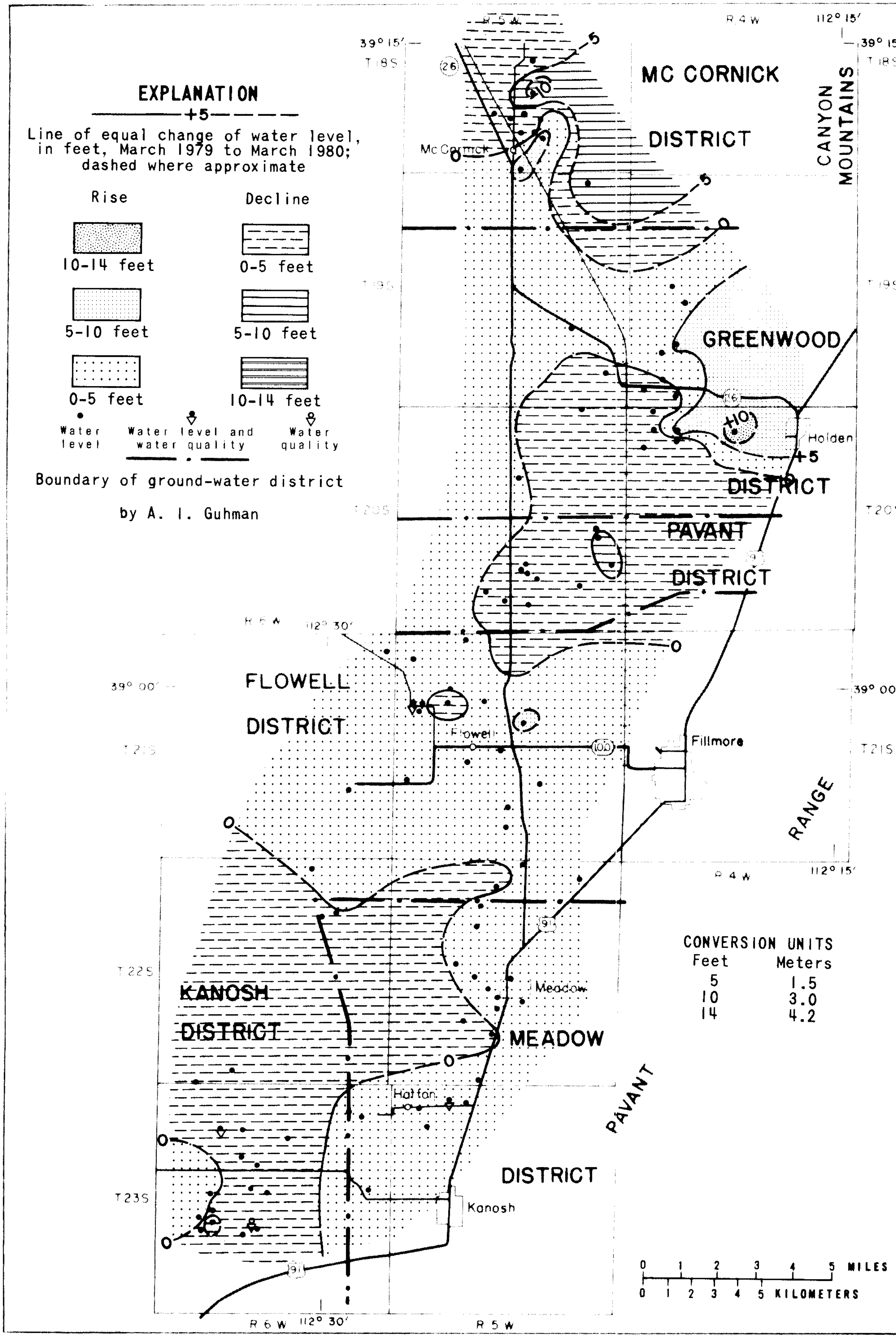



Figure 25.—Map of Pavant Valley showing change of water levels from March 1979 to March 1980.

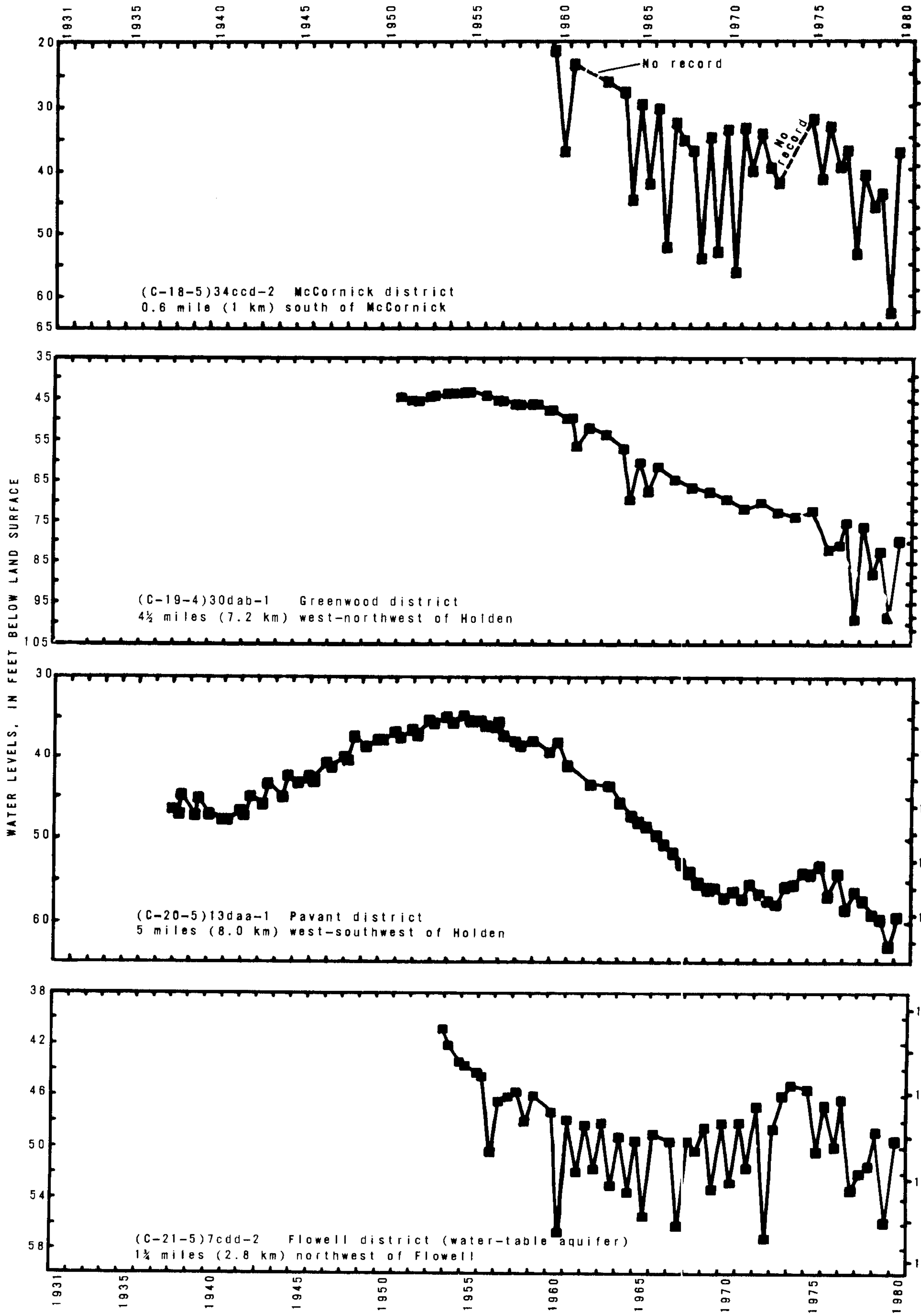



Figure 26.—Relation of water levels in selected wells in Pavant Valley to cumulative departure from the average annual precipitation at Fillmore and to annual withdrawals from wells.

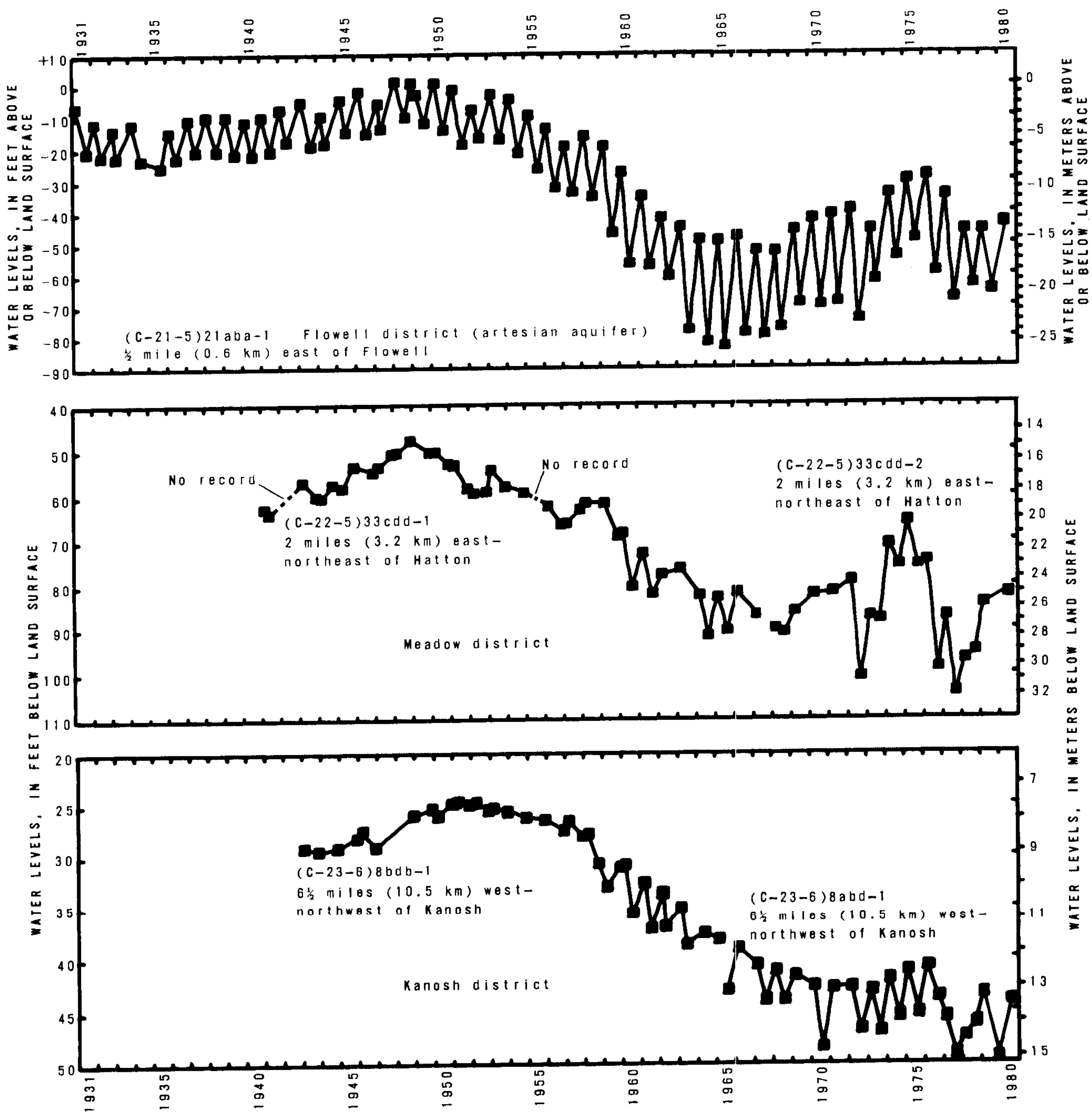



Figure 26.— Continued.

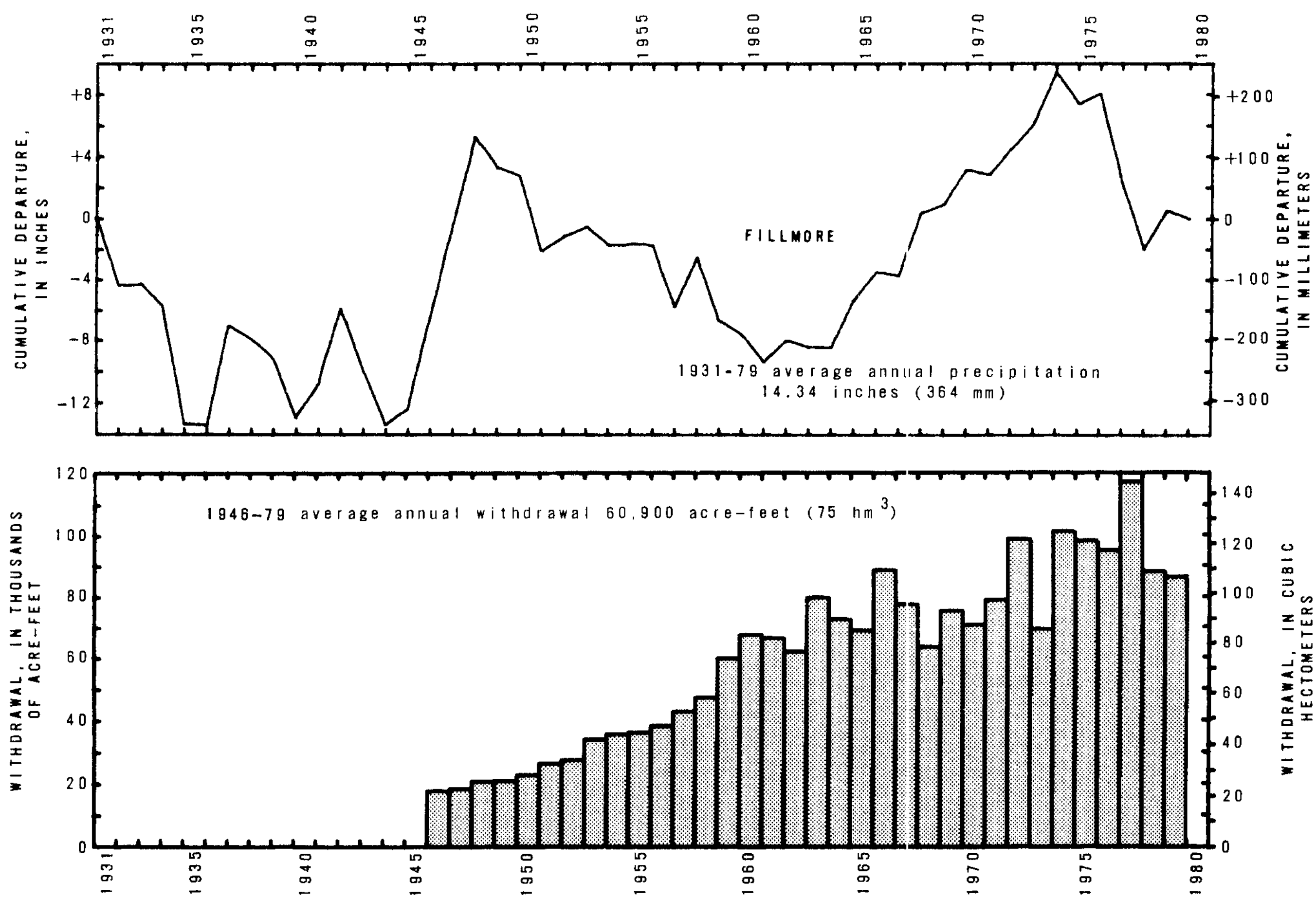



Figure 26.— Continued.

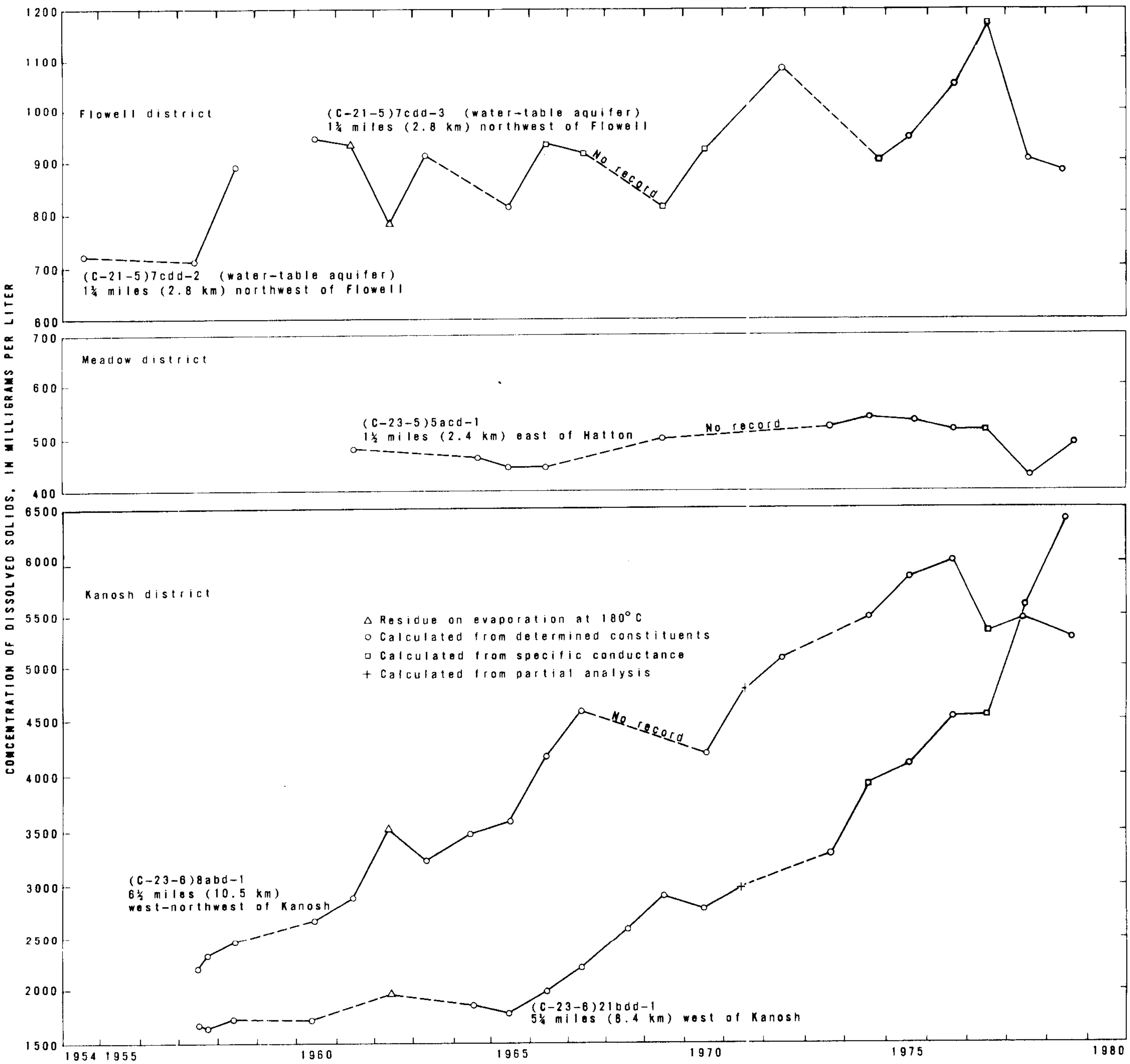



Figure 27.—Concentration of dissolved solids in water from selected wells in Pavant Valley.

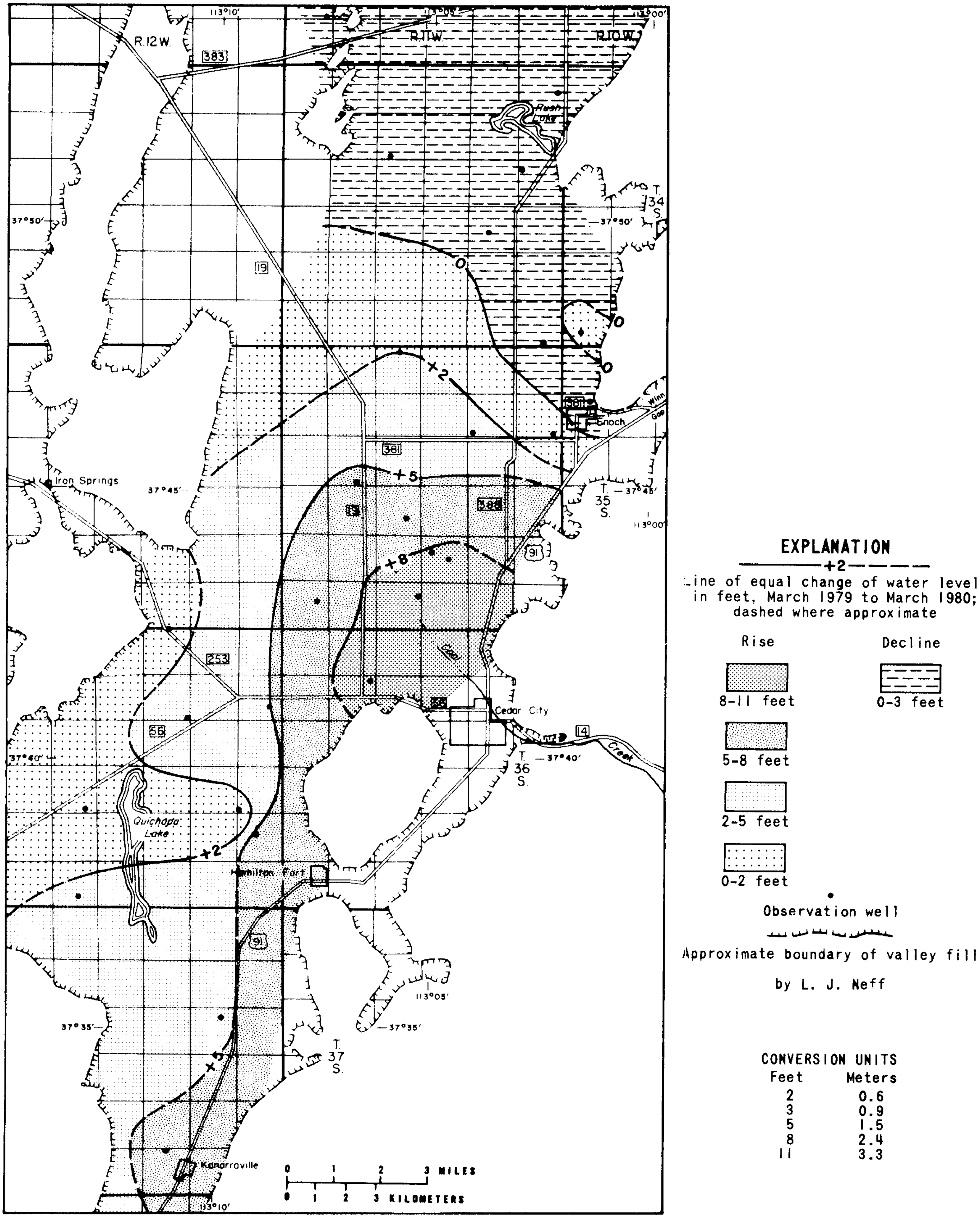



Figure 28.—Map of Cedar City Valley showing change of water levels from March 1979 to March 1980.

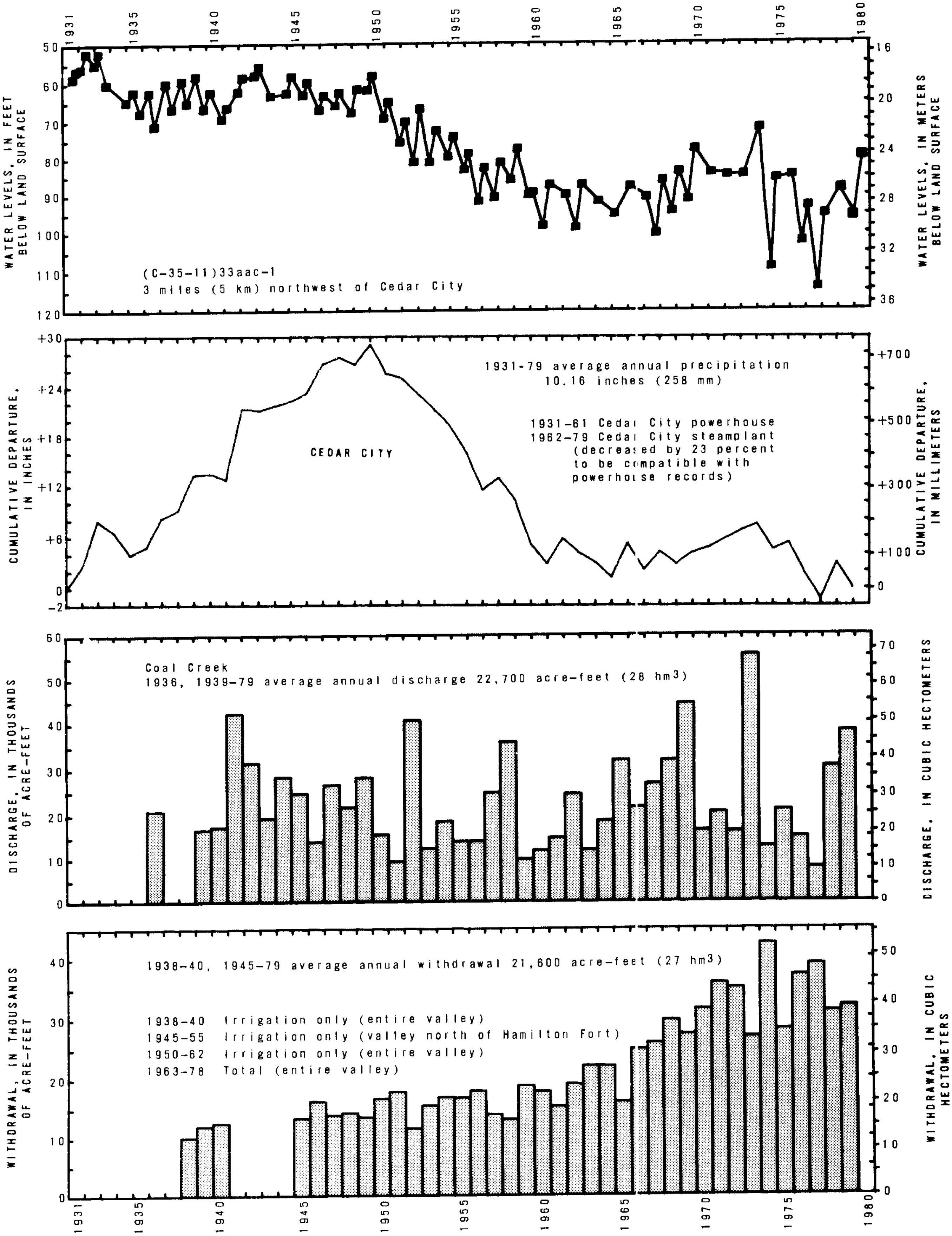



Figure 29.—Relation of water levels in well (C-35-11)33aac-1 in Cedar City Valley to cumulative departure from the average annual precipitation at the Cedar City powerhouse, to discharge of Coal Creek near Cedar City, and to annual withdrawals from wells.

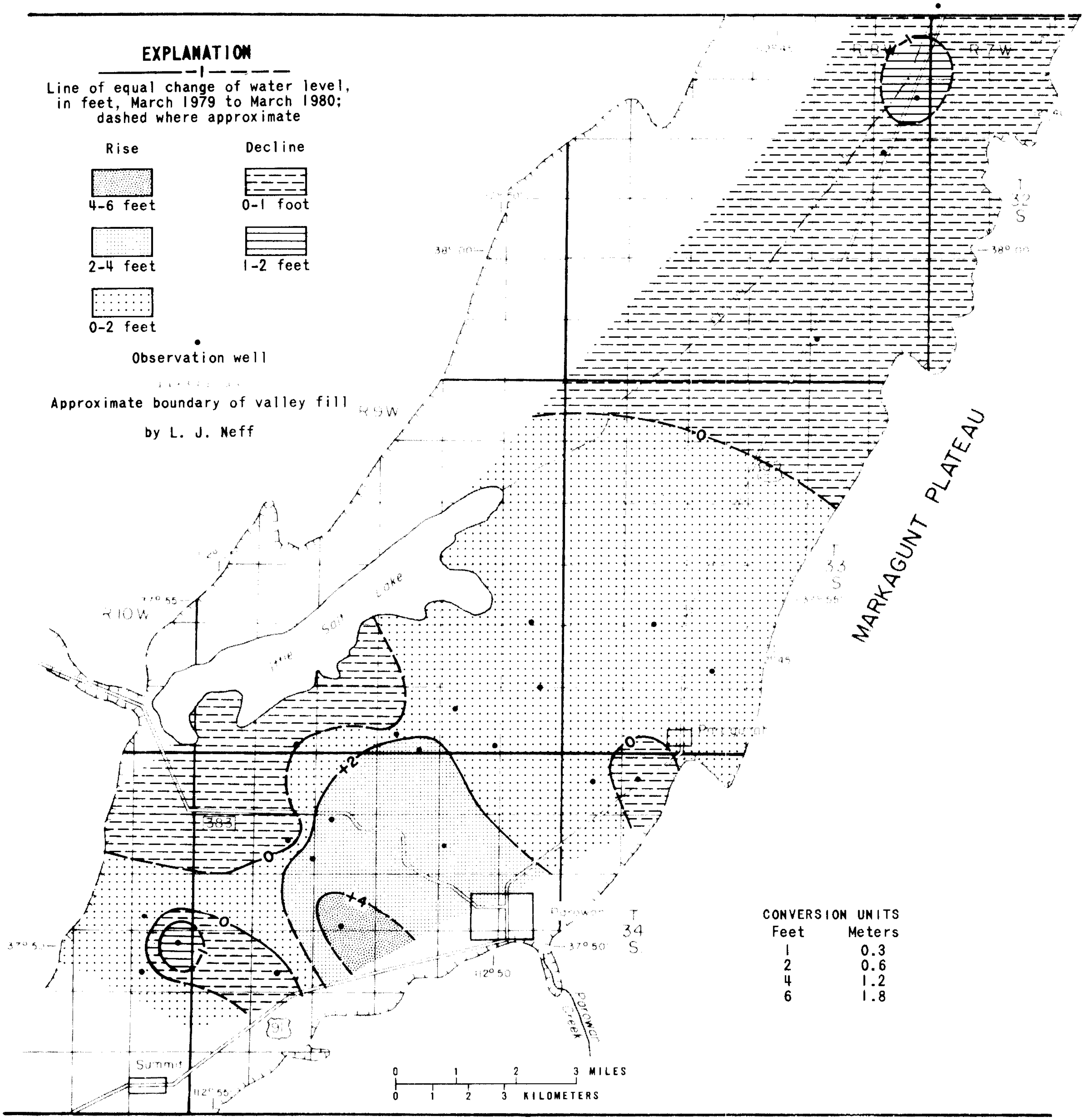



Figure 30.—Map of Parowan Valley showing change of water levels from March 1979 to March 1980.

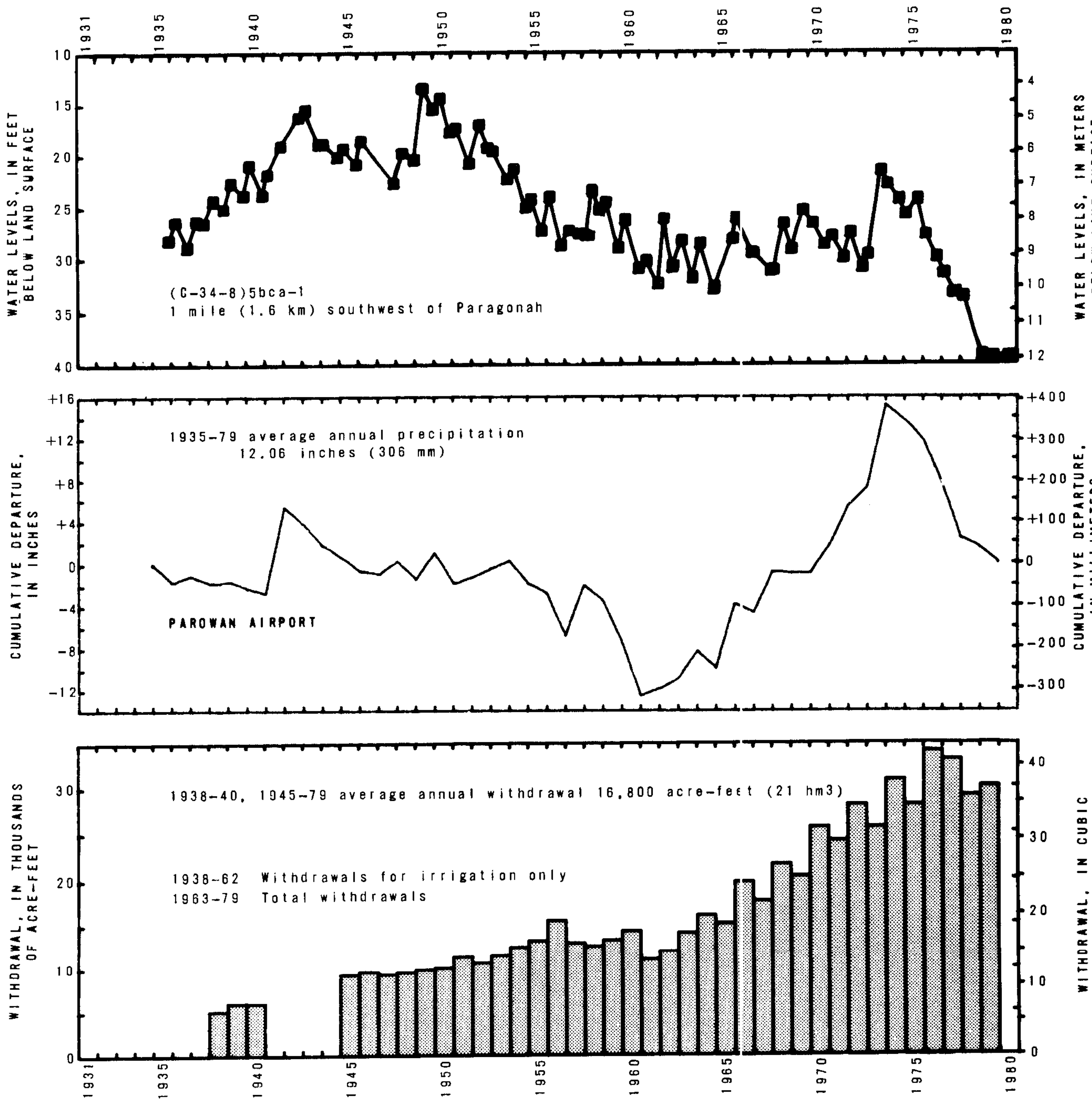



Figure 31.—Relation of water levels in well (C-34-8)5bca-1 in Parowan Valley to cumulative departure from the average annual precipitation at Parowan Airport and to annual withdrawals from wells.

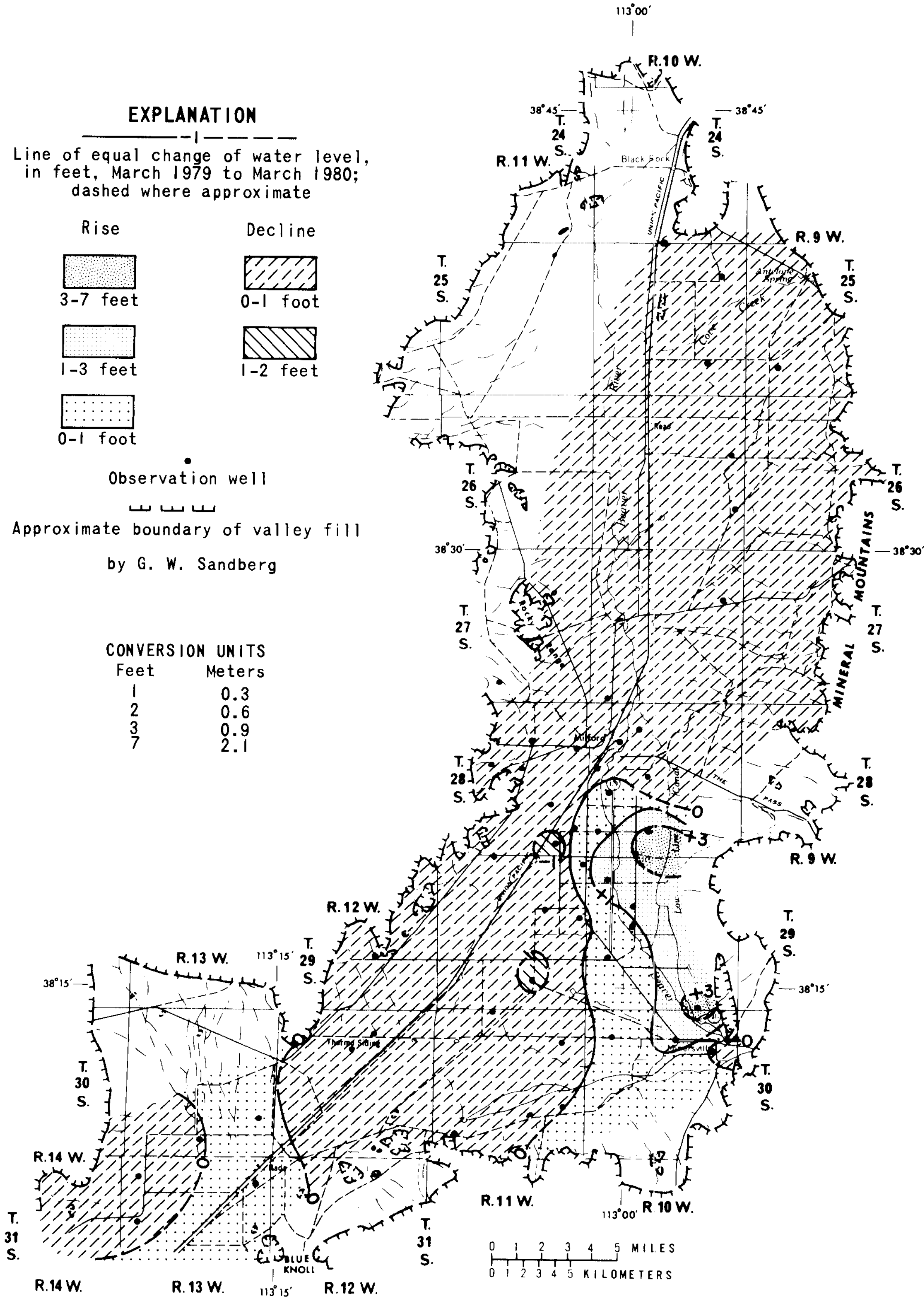



Figure 32.—Map of the Milford area, Escalante Valley, showing change of water levels from March 1979 to March 1980.

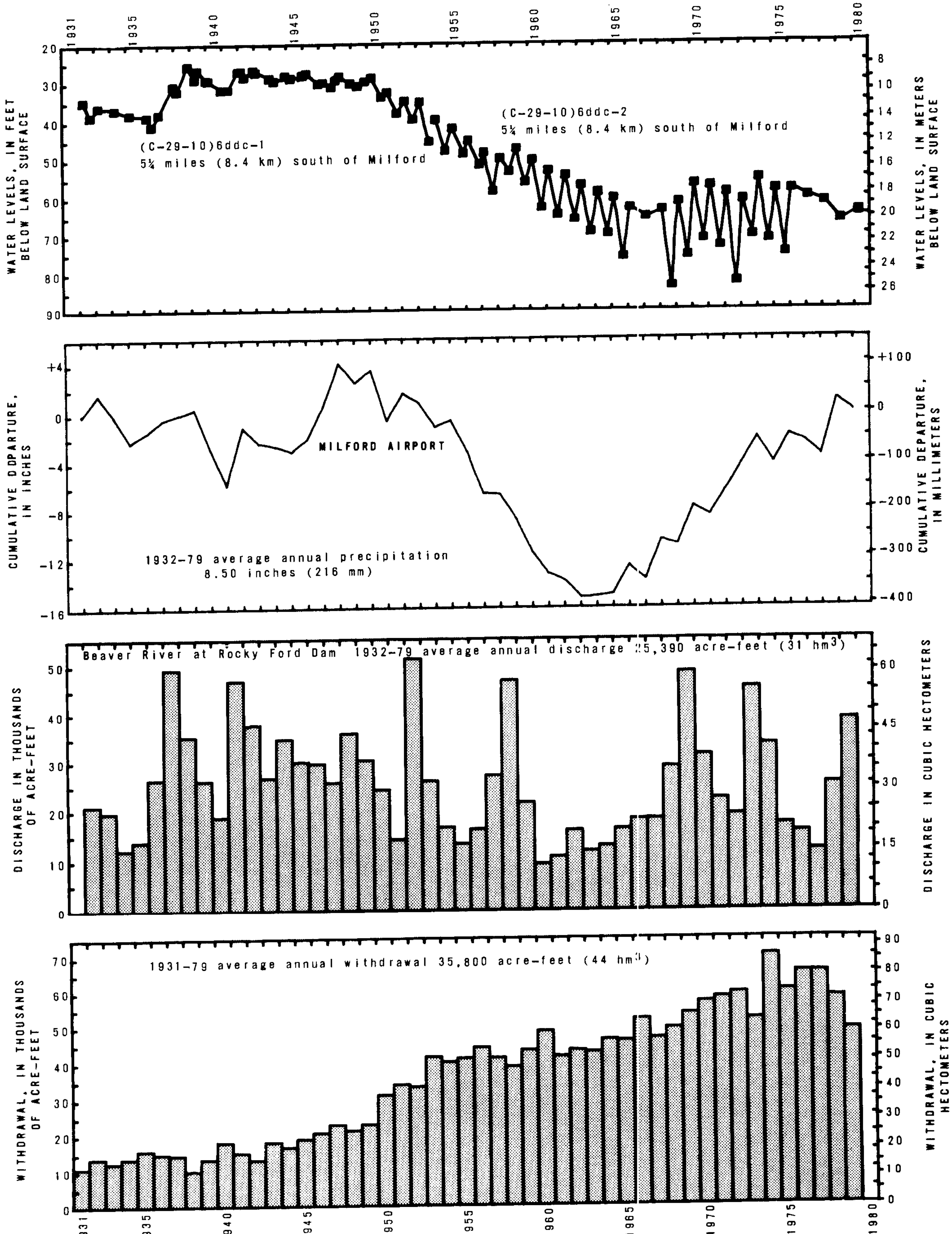



Figure 33.—Relation of water levels in well (C-29-10)6ddc-2 in the Milford area, Escalante Valley, to cumulative departure from the average annual precipitation at Milford Airport, to discharge of the Beaver River at Rocky Ford Dam, and to annual withdrawals from wells.

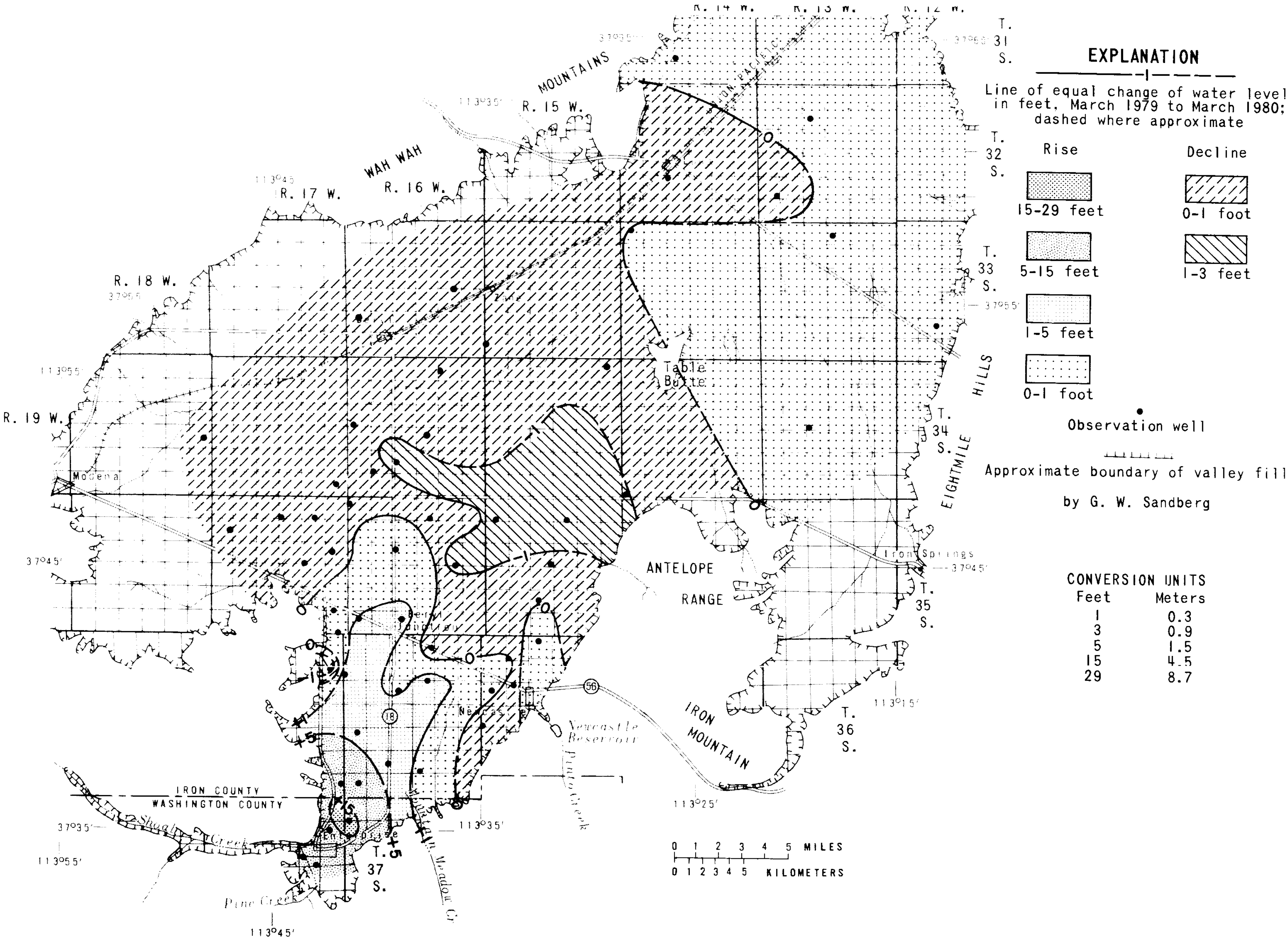



Figure 34.—Map of the Beryl-Enterprise area, Escalante Valley, showing change of water levels from March 1979 to March 1980.

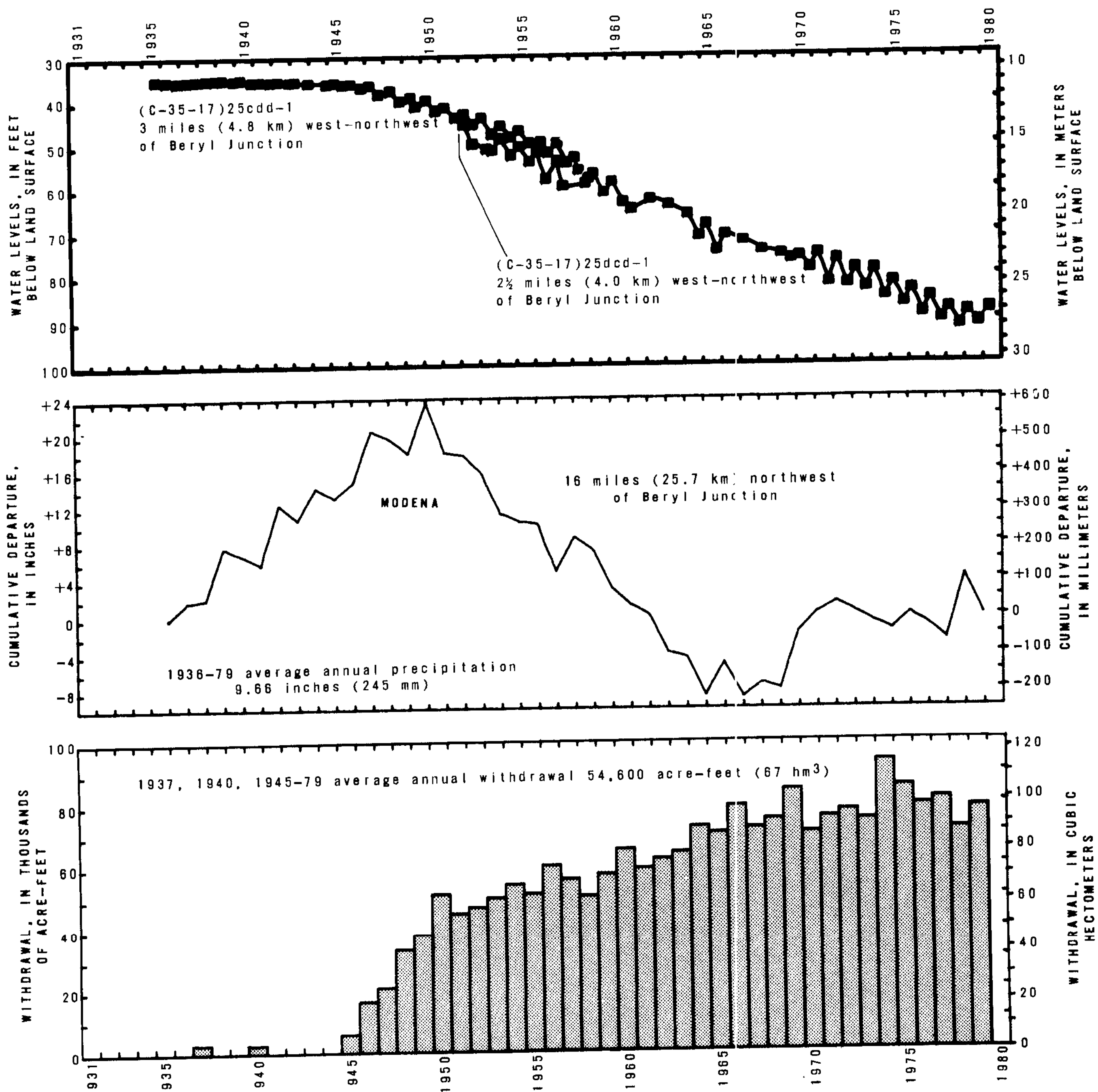



Figure 35.—Relation of water levels in well (C-35-17)25dcd-1 in the Beryl-Enterprise area, Escalante Valley, to cumulative departure from the average annual precipitation at Modena and to annual withdrawals from wells.

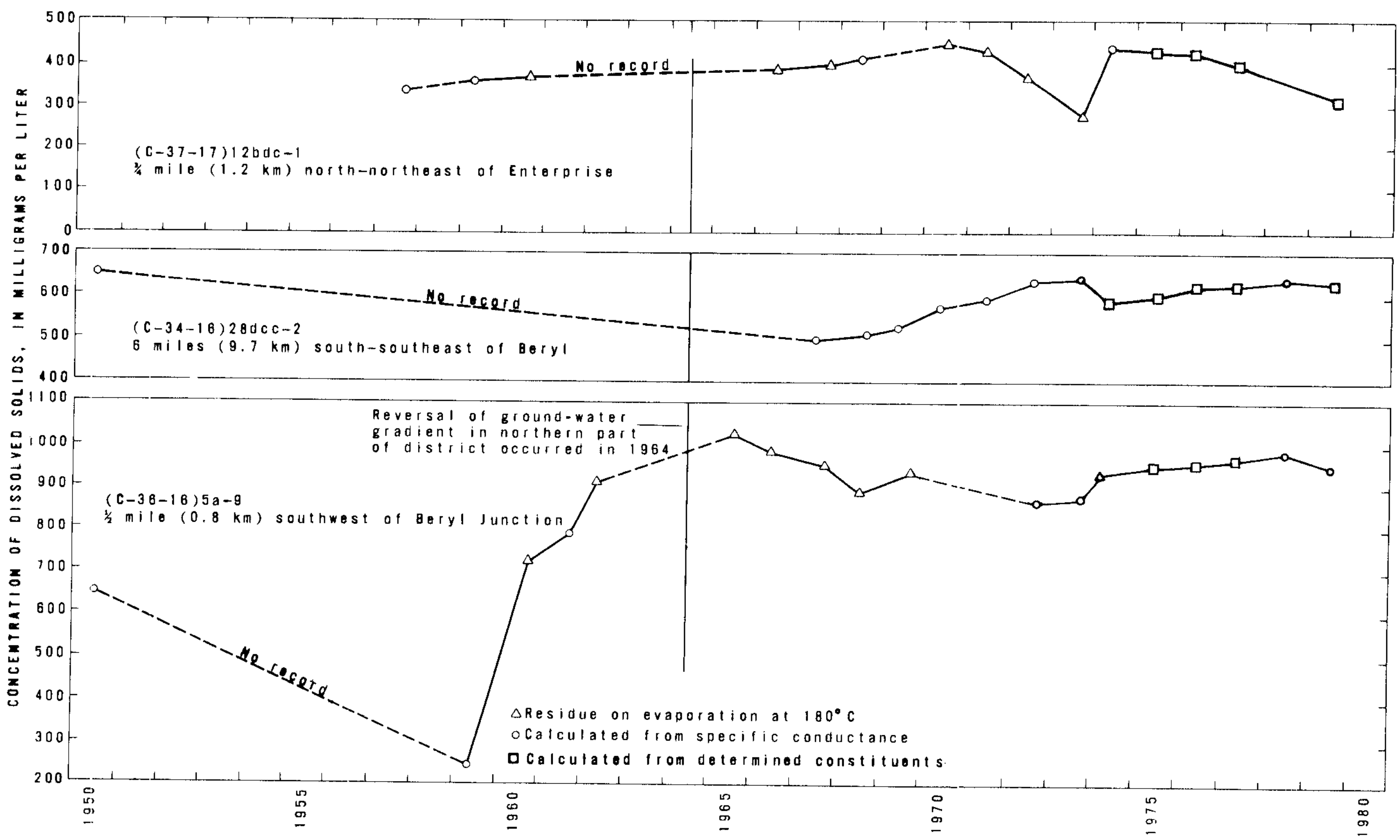



Figure 36.— Concentration of dissolved solids in water from selected wells in the Beryl-Enterprise area, Escalante Valley.

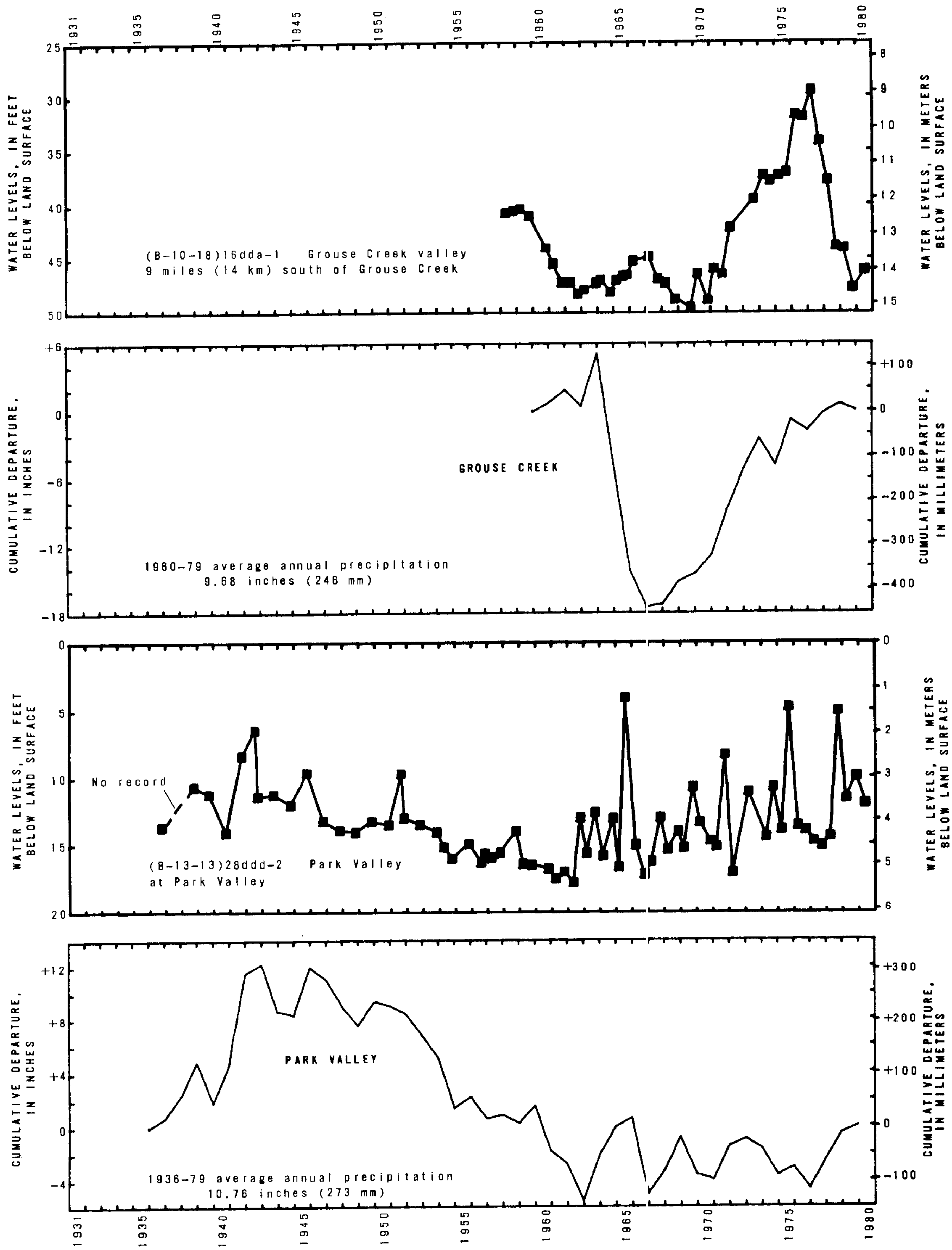



Figure 37.— Relation of water levels in wells in selected areas of Utah to cumulative departure from the average annual precipitation at sites in or near those areas and also total withdrawals from wells in "Other areas."

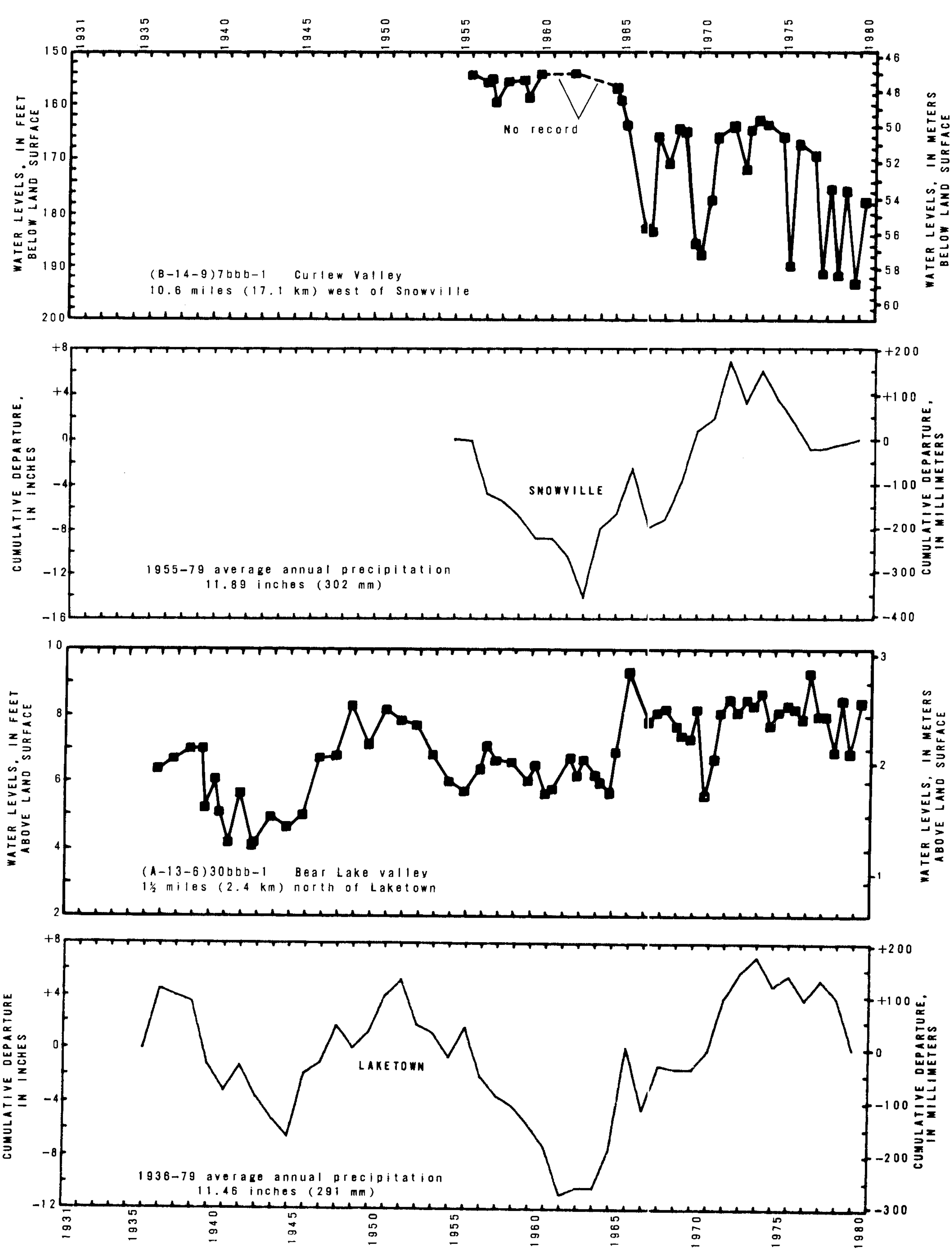



Figure 37.— Continued.

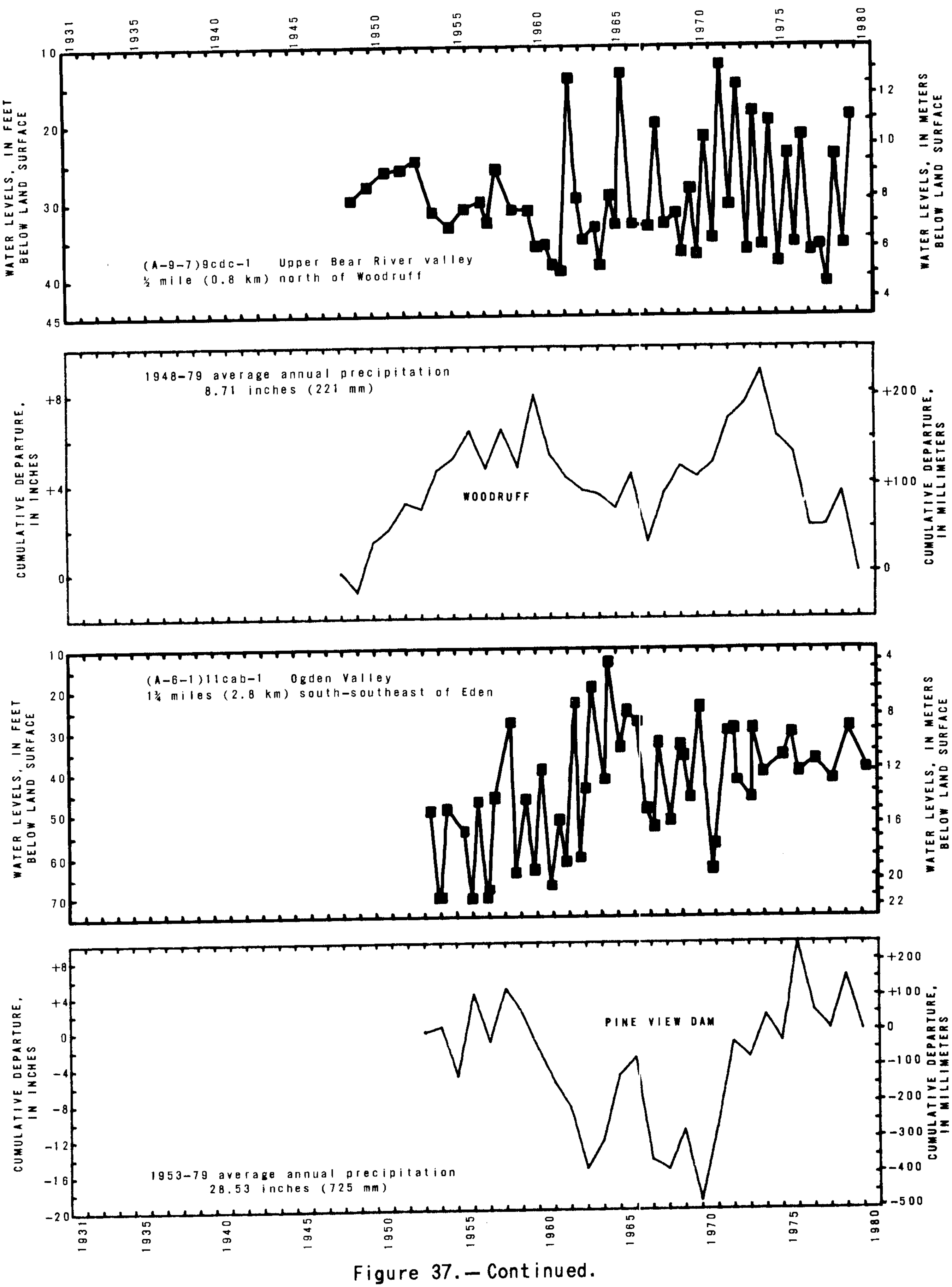



Figure 37.— Continued.

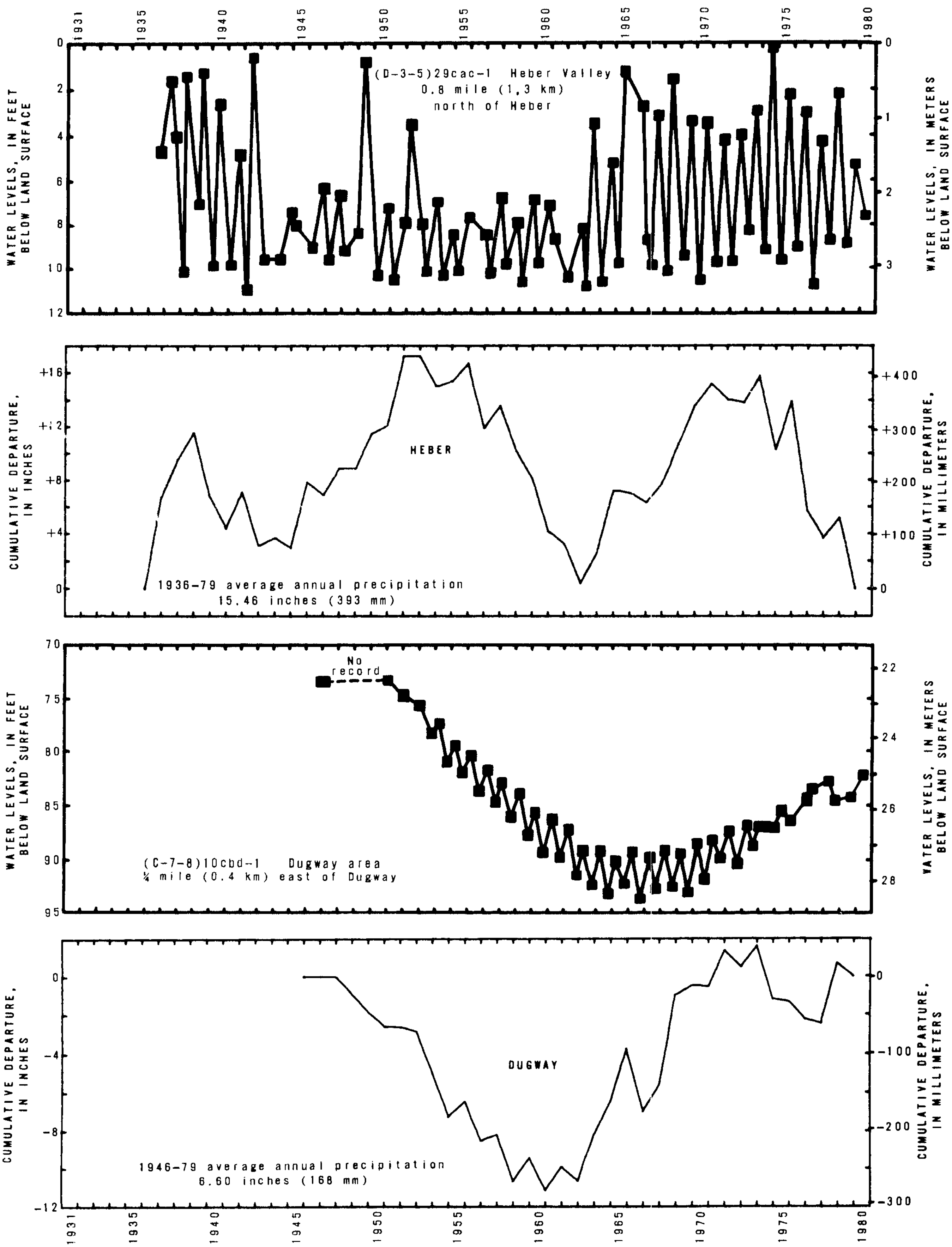



Figure 37.—Continued.

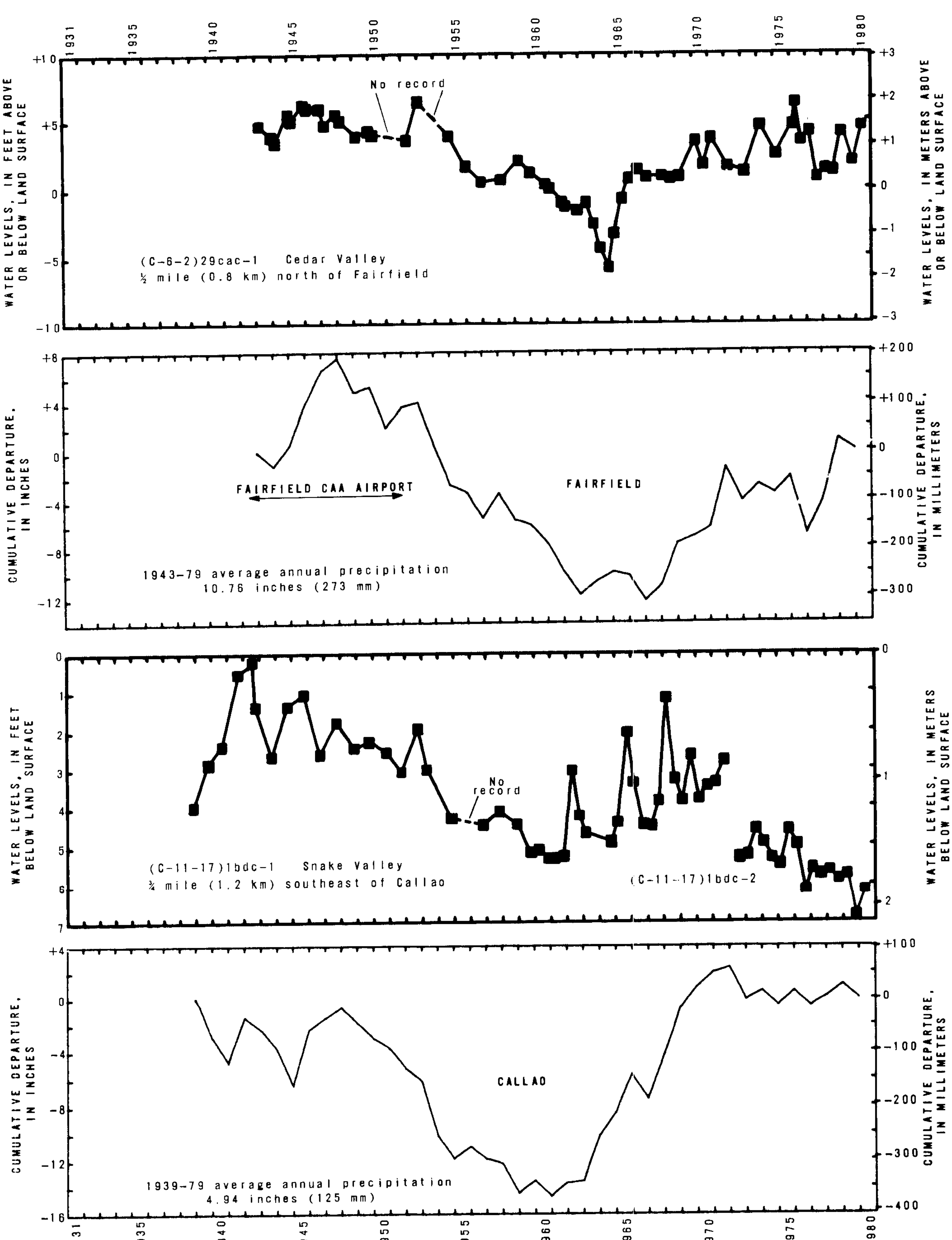



Figure 37.—Continued.

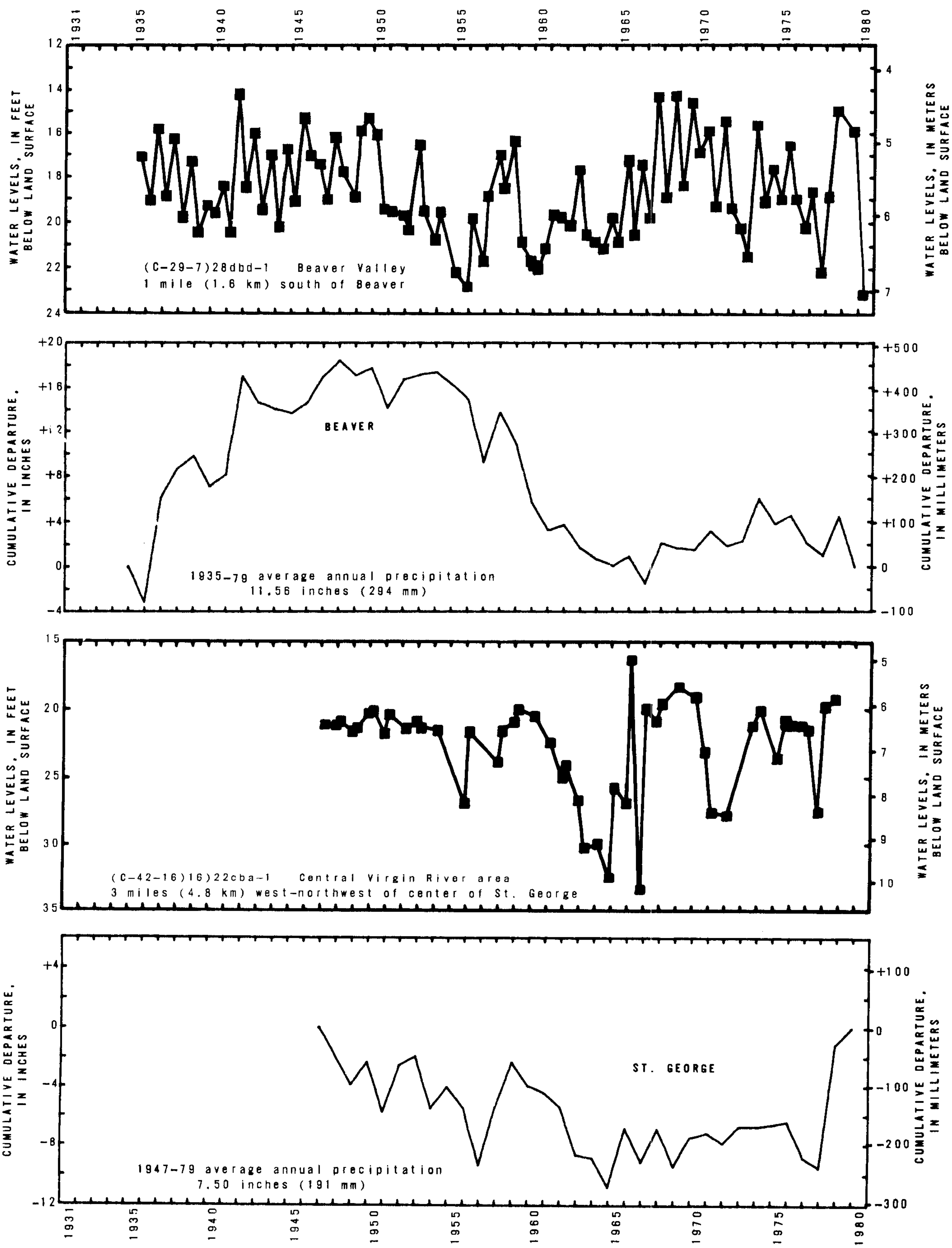



Figure 37.— Continued.

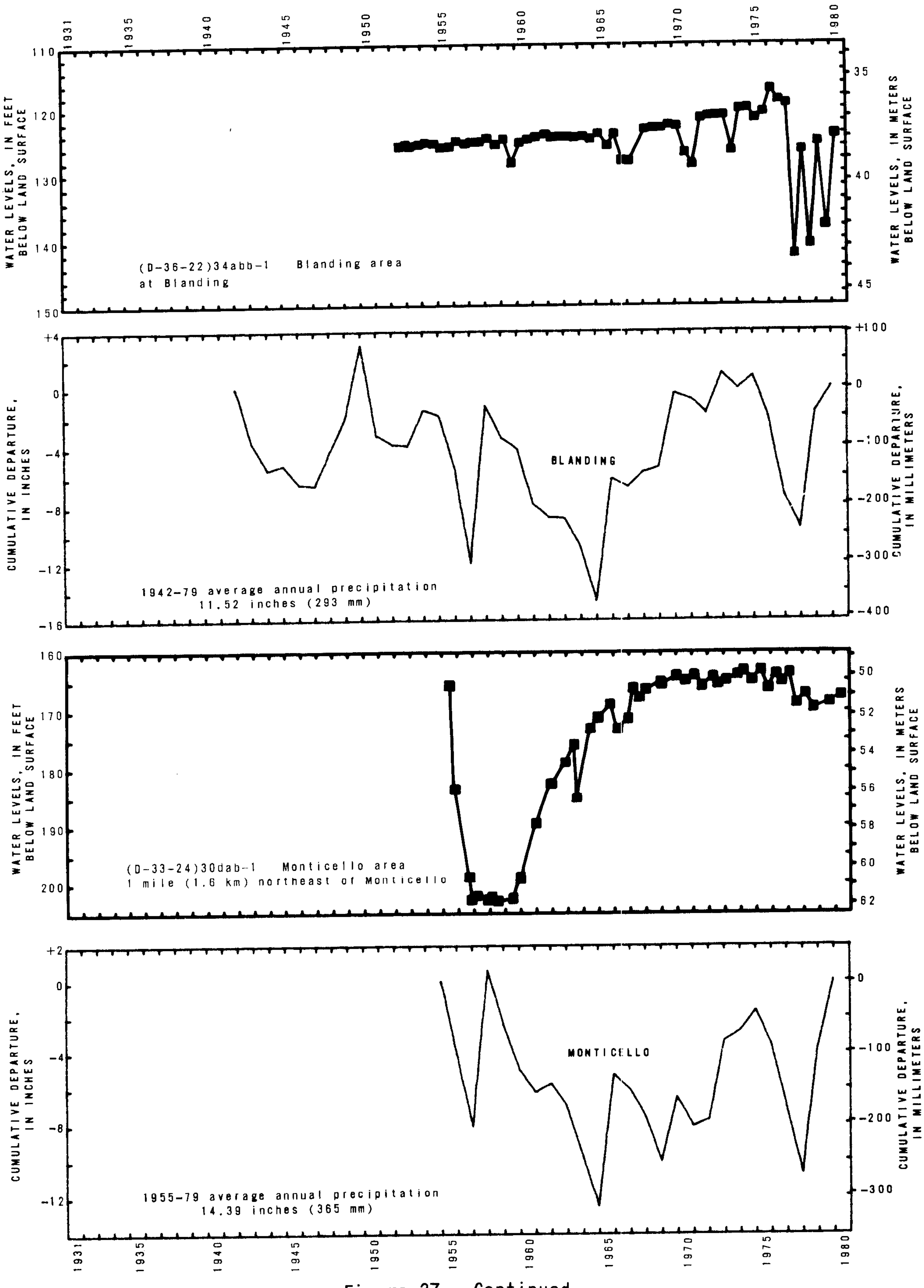



Figure 37.—Continued.

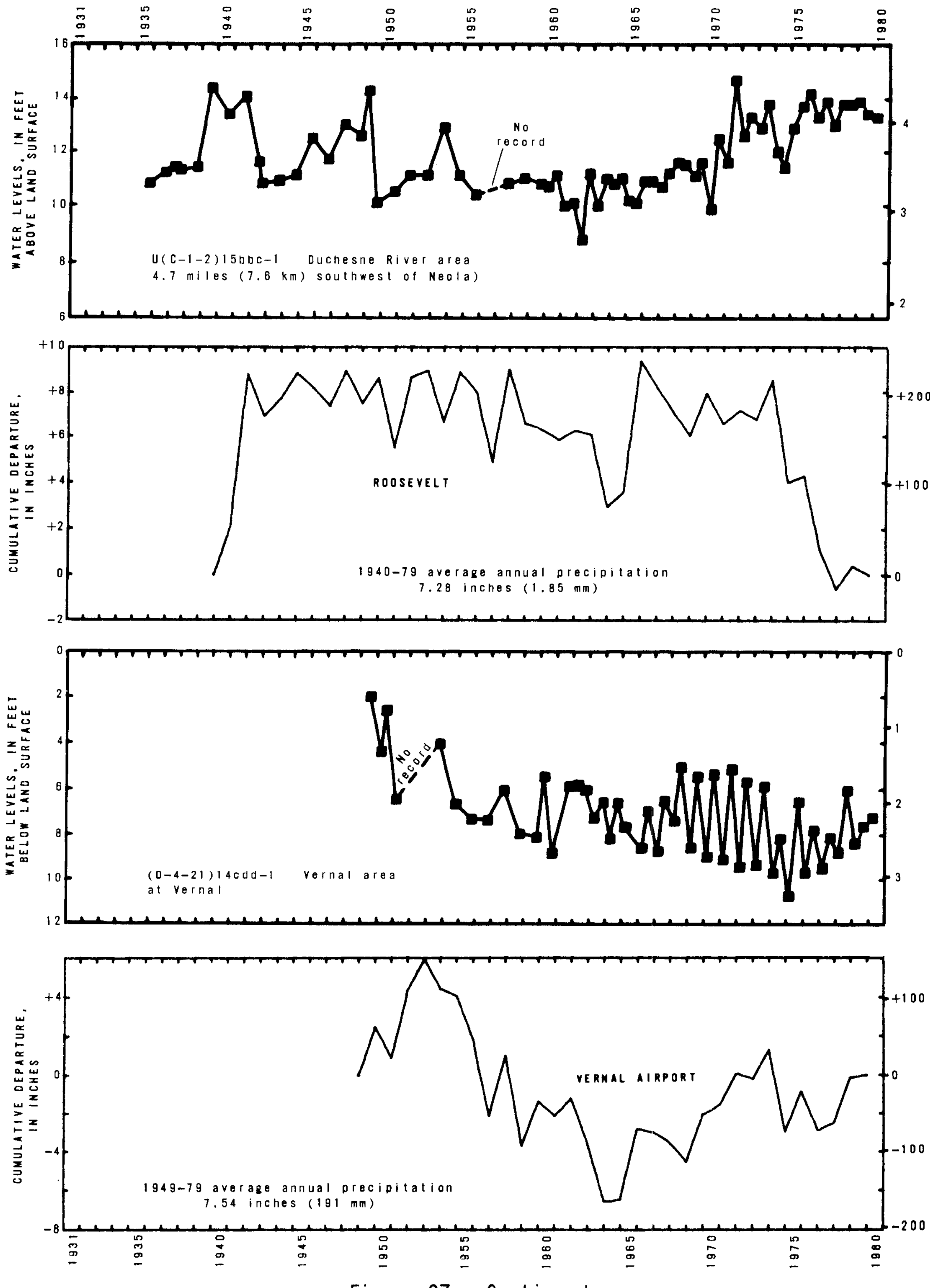



Figure 37.— Continued.

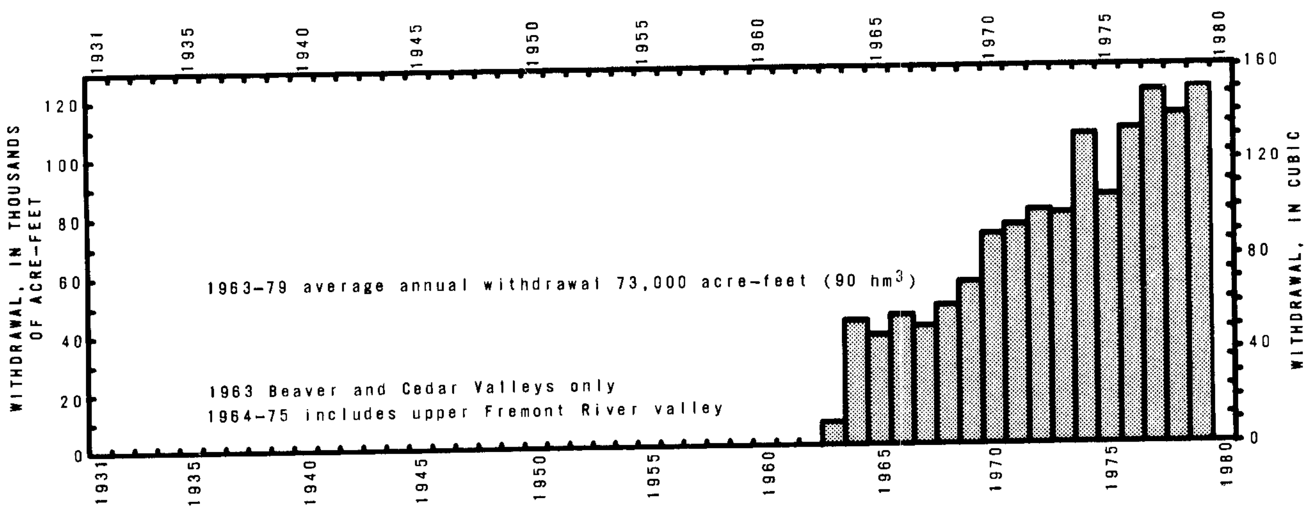



Figure 37.—Continued.

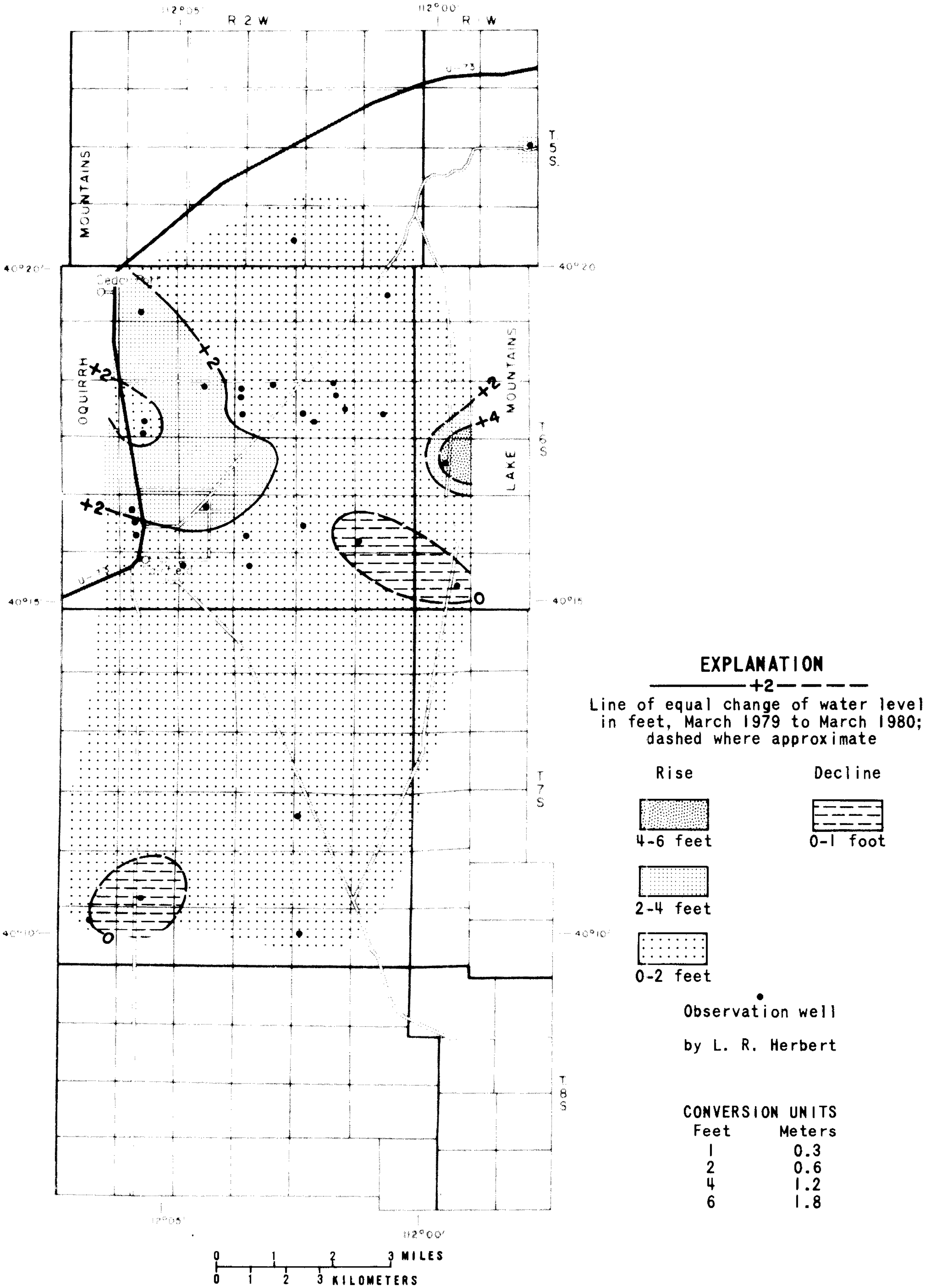



Figure 38.—Map of Cedar Valley showing change of water levels from March 1979 to March 1980.

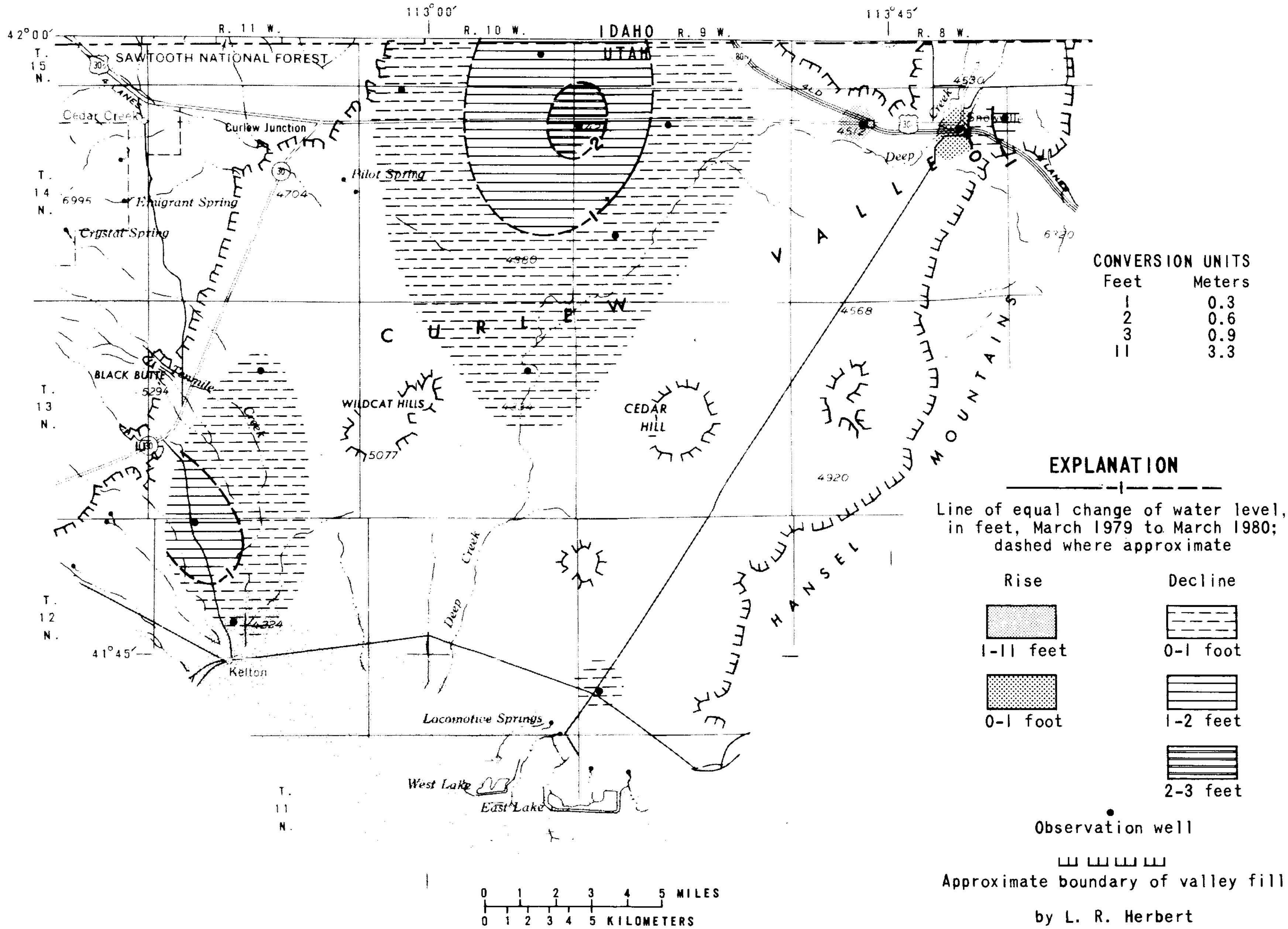



Figure 39.—Map of Curlew Valley showing change of water levels from March 1979 to March 1980.